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US ARMY
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DYNAMIC SYSTEM COUPLER PROGRAM (DYSCO 4.1)
VOLUME III - USER'S MANUAL SUPPLEMENT

Alex Berman, Shyi-Yuang Chen, Bruce Gustavson, Patricia Hurst

Kaman Aerospace Corporation
P.O. Box 2
Bloomfield, CT 06002-0002

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AVIATION APPLIED TECHNOLOGY DIRECTORATE
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AVIATION APPLIED TECHNOLOGY DIRECTORATE POSITION STATEMENT

This report documents the work performed to enhance the Dynamic System Coupler (DYSCO) computer program through the addition of advanced modeling capabilities. These capabilities include rotor blade damage modeling, Eigen analysis development, general time history solution development, frequency domain solution development, general modal representation of three-dimensional structures, lifting surface modal representation, landing gear, general force, linear constraints, lifting surface aerodynamics, calculation of component interface and internal loads, and a nonlinear spring and damper system. While the improvements incorporated into DYSCO, as a result of this work, increase the analytical capabilities of the program, it still has limitations in several areas. More correlation with flight test data or with similar proven analytical tools is needed to validate program results. A new or improved trim algorithm is needed to eliminate deficiencies in the current DYSCO trim algorithm. Also, DYSCO should be converted to double precision to increase the accuracy of program results.

Mr. Robert A. Lindholm of the Aeronautical Technology Division served as the project engineer for this contract.

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Alex Berman, Shyi-Yuang Chen, Bruce Gustavson, Patricia Hurst

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DYSCO is an interactive computer program which allows a user to model the dynamic and aerodynamic behavior of rotorcraft and other aerospace structures. The program provides user-oriented modeling procedures and data base management for dynamic analyses of coupled systems of independently modeled components. Each component is a system of second-order ordinary differential equations. The user employs modules from an expandable library of algorithms to formulate and couple components and to obtain solutions of the coupled system.

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1.0 DYSCO 4.0, 4.1 COMPARISON

A brief description of the Component and Solution Technology Modules included in the previous implementation, DYSCO 4.0, and those added under the current implementation, DYSCO 4.1, is presented for comparison.

1.1 DYSCO 4.0 COMPONENT TECHNOLOGY MODULES

1.1.1 CFM2 - Fuselage, Modal. CFM2 is a modal, thin-beam representation which can be used to model a fuselage or similar structures. Special provision has been made to allow direct coupling with rotor hub degrees of freedom and, more generally, with other arbitrary implicit degrees of freedom (translation only) defined along the principal axis. Interpolation of the modal displacements and slopes is automatically performed to obtain the displacements of the implicit degrees of freedom with respect to the CFM2 coordinate system.

1.1.2 CRR2 - Rotor, Rigid Blades. CRR2 is a rotor system representation with rigid hinged blades having flap, lag, and pitch degrees of freedom defined in a rotating coordinate system and hub rigid body degrees of freedom defined in a fixed system.

1.1.3 CRE3 - Rotor, Elastic Blades. CRE3 is a rotor system representation with modal representations of elastic hinged blades which may include out-of-plane, in-plane, and torsion degrees of freedom defined in a rotating coordinate system. A rotor speed perturbation degree of freedom (angular displacement of the entire rotor about the shaft axis with respect to the rotating system) can also be defined. Hub rigid body degrees of freedom can be defined in a fixed coordinate system.

1.1.4 CCE1 - Control System, Elastic Rods. CCE1 represents a rotor control system consisting of damped elastic control rods which can be coupled directly to the blade pitch degrees of freedom of a rigid rotor system or to the blade torsion degrees of freedom of an elastic rotor system, through a rigid pitch

horn. Swashplate degrees of freedom can be defined with respect to the hub coordinate system.

1.1.5 CCEØ - Control System, Elastic Rods. CCEØ represents a rotor control system consisting of undamped elastic rods which can be coupled directly to the blade degrees of freedom of rigid or elastic rotors through a rigid pitch horn.

Transformation of time-varying coefficients from the rotating coordinate system to the fixed system is performed by the component Active Modules of CRR2, CRE3, CCE1, and CCEØ during time-integration type solutions.

1.1.6 CSF1 - Structure, Finite Element. CSF1 represents an arbitrary, linear, constant coefficient set of second-order differential equations:

$$M\ddot{X} + C\dot{X} + KX = F$$

Through the explicit coupling mechanism, CSF1 can be used to couple components or modify the constant coefficients of a system.

1.1.7 CES1 - Elastic Stop (Nonlinear Spring). CES1 represents multiple spring-damper elements which can have zero damping and stiffness over specified displacement gaps. CES1 elements allow a degree of freedom to move freely through a specified distance before encountering the resistance of a spring or damper. These elements can be used in parallel to assemble piecewise-linear representations of nonlinear springs and dampers.

1.1.8 CLC1 - Linear Constraints. CLC1 is used to apply arbitrary linear constraints to the degrees of freedom of a system. The user formulates equations in which existing (implicit) degrees of freedom are set equal to and are replaced by functions of other arbitrary degrees of freedom. The coefficients of these functions are constants specified by the user. CLC1 allows the user to create rigid, pinned, or elastic couplings between components or to apply scale factors to degrees of freedom. A degree of freedom may be eliminated by setting it equal to zero.

1.2 DYSCO 4.1 COMPONENT TECHNOLOGY MODULES

1.2.1 CFM3 - Fuselage, Modal (3-d). CFM3 is a general modal representation for 3-dimensional elastic structures. Normal modes are specified at node points defined in a 3-dimensional coordinate system. Direct coupling with other components is only allowed at the node points, and no modal interpolation is performed, but up to three translational and three rotational implicit degrees of freedom can be defined locally at each node point. This implies that the user need only define the elastic modes at points or attachment to other components.

1.2.2 CRD3 - Rotor, Damaged (Nonidentical) Blades. CRD3 allows changes to be made to the physical and geometric properties of single or multiple blades of an existing elastic rotor component (CRE3) in a model. CRD3 allows the user to specify changes in blade properties without affecting or re-inputting the other rotor system data. By selecting blade numbers, the user specifies the blade degrees of freedom for which new coefficients will be calculated. These component matrices are combined in the system equations like those of any other component and do not replace the original CRE3 component matrices. Thus, the blade changes are additive.

1.2.3 CLC2 - Linear Constraints. CLC2 is used to apply arbitrary linear constraints to the degrees of freedom of a system. Instead of formulating a set of relationships between degrees of freedom and selecting and solving for the implicit degrees of freedom (CLC1), the user need only specify the given relationships and implicit degrees of freedom and CLC2 will automatically solve for the implicit degrees of freedom. Using the same set of relationships, the user can do modeling with different sets of implicit degrees of freedom without having to solve for each set of implicit coefficients.

1.2.4 CLCØ - Linear Constraints. CLCØ is a simplified version of CLC2 which can be used to eliminate degrees of freedom from a system. The implicit coefficients are automatically set to zero.

1.2.5 CGF2 - General Force. CGF2 is used to apply general periodic forces to component and system degrees of freedom. CGF2 is a component with null mass, damping, and stiffness matrices and a time-varying force vector which can be defined as a combination of polynomial, Fourier series, and tabular functions. Through the explicit coupling mechanism, CGF2 can be used to apply forces to the degrees of freedom of other components.The periodicity of the forces can be augmented or be reduced to single applications through specifications of start and end times.

1.2.6 CLG2 - Landing Gear. CLG2 is a general nonlinear representation of a landing gear strut and tire. Rigid body degrees of freedom are defined at a point designated as the point of attachment for other components. An elastic strut elongation degree of freedom is defined along the strut principal axis. Tire degrees of freedom and, optionally, tire scrubbing degrees of freedom are defined, allowing brakes on and off, tire scrubbing, and tire leaving the ground conditions to be modeled for time history investigations. The stiffness and damping coefficients for the strut and tire are defined as piecewise linear functions of the displacement and velocity of the strut elongation and tire degrees of freedom. Thus, preloaded systems can be modeled.

1.2.7 CLS2 - Modal Lifting Surface. CLS2 is a specialized modal representation for a planar lifting surface structure with a rigid hinged control surface. Rigid body degrees of freedom are defined at an arbitrary attachment point, and elastic modes are defined at stations along the principal (spanwise) axis. Implicit degrees of freedom may be defined at node points in the plane of the structure. In addition, a control surface rigid rotation degree of freedom may be defined. Finally, the user can automatically mirror the degrees of freedom and create a structure which is symmetric about its centerline, as in the case of a full wing structure.

1.2.8 CGLØ - Global Transformation. CGLØ is a model dependent component which forms the matrices used by time history and trim solutions to transform gravitational and centrifugal acceleration vectors from the global (model)

coordinate system to the individual component coordinate systems. Model sequence numbers identify the data sets for which transformation is required, and the transformation matrices are formulated from the direction cosines of the component X and Y coordinate axes with respect to the global coordinate system.

1.2.9 CSF3 - Nonlinear Spring, Damper System. CSF3 represents an arbitrary, constant coefficient set of second order differential equations of the form

$$M\ddot{X} + C\dot{X} + KX + C_2\dot{X}^2 + C_3\dot{X}^3 + K_2X^2 + K_3X^3 + DX\dot{X} + AX\dot{X}^2 + BX^2\dot{X} = F$$

where M, C, K, C_2, C_3, K_2, K_3, D, A, and B are coefficient matrices. F is a constant force vector, and X is the displacement vector of the system degrees of freedom.

1.2.10 Component Loads Modules. A new component Technical Module, the Component Loads Module (C---L), has been implemented in conjunction with a new Solution Module, SII3, to compute and print out the time history internal loads acting on the component degrees of freedom. Internal loads are defined as the forces and moments due to the component stiffness and damping which act on a degree of freedom with a given displacement and velocity. C---L can be called by the Solution Active Module, SII3A, which processes the system state vectors saved from a time history solution.

The internal loads and other time history derived quantities computed by the currently installed Loads Modules are briefly described below.

1.2.10.1 CSF1L - The forces and moments exerted by the component springs and dampers are calculated. In addition, the associated strain energies and viscous damping energy dissipation rates are calculated.

1.2.10.2 CES1L - The forces and moments exerted by spring-damper elements are calculated. In addition, the associated strain energies and viscous damping energy dissipation rates are calculated.

1.2.10.3 CRE3L, CRD3L - The in-plane and out-of-plane bending moments and the twisting moments due to shear are calculated at blade stations selected by the user.

1.3 DYSCO 4.0 SOLUTION TECHNOLOGY MODULES

All Solution Input Technical Modules are now constructed in the input table format previously used only by Component and Force Input Modules and interact with the DYSCO Input Processor (DIP). This provides a consistent means of creating and retrieving the data required by a Solution Module. It provides for consistency in prompting the user for input, in validating the input, and in handling erroneous input and reduces the programmer effort required to construct a new Solution Module. Solution Modules created prior to the DYSCO 4.1 implementation were converted to the input table format.

1.3.1 SEA3 - Eigenanalysis. SEA3 computes the eigenvalues and the eigenvectors of the constant M and K matrices of a system using the power method. Solutions cannot be obtained for systems with rigid body modes, and only system eigenvectors can be output.

1.3.2 SEA4 - Eigenanalysis. SEA4 computes the eigenvalues and eigenvectors, including rigid body modes, of the constant M and K matrices of a system using the Householder method. Only system eigenvectors can be output.

1.3.3 STH3 - Time History. STH3 performs a Runge-Kutta integration of the system equations with generalized initial conditions and an optional error check. Helicopter rotor control parameters can be input and the computed aerodynamic forces and torque on the rotor hub can optionally be output. As part of the DYSCO 4.1 implementation, STH3 time history state vectors can optionally be saved for interface and internal loads calculations (SII3).

1.3.4 SSF3 - Stability Floquet. SSF3 uses periodic shooting to determine initial conditions for which a Runge-Kutta integration with optional error

check is performed on the general linear or nonlinear system equations. New initial conditions are determined and the integration is repeated to achieve the periodic equilibrium condition. Perturbation of the periodic equilibrium state is performed by the n-pass method in order to form the Floquet transition matrix, on which an eigenanalysis is performed and the stability of the system evaluated.

SSF3 is used primarily to determine the complex eigenvalues and eigenvectors and hence, the stability of systems that include periodic (time-varying) coefficients such as helicopter simulations, but is also useful for damped systems with constant coefficients. Helicopter rotor control parameters can also be input in the same manner as that for STH3.

1.3.5 STR3 - Trim. STR3 combines periodic shooting and the Newton-Raphson method, using an iterative scheme to find the periodic equilibrium state and the control settings for a specified helicopter (single rotor) flight condition. Optionally, immediately following the trim solution, a time history can be performed using the conditions from the last trim iteration as initial conditions. As part of the DYSCO 4.1 implementation, STR3 time history state vectors can optionally be saved for interface and internal loads calculations (SII3).

1.4 DYSCO 4.1 SOLUTION TECHNOLOGY MODULES

1.4.1 SEA5 - Eigenanalysis. SEA5 computes the complex eigenvalues and eigenvectors, including rigid body modes, of the constant M, C, and K matrices of a system using a generalized Householder algorithm. The user can select the component, as well as system degrees of freedom for which the eigenvectors will be output.

1.4.2 STH4 - Time History. STH4 performs the same Runge-Kutta integration of the system equations with the same basic solution options as STH3, but rotor controls input and rotor force output options are not available. However, the

user can select the component and system degrees of freedom for which the state vector or, separately, displacement or velocity, will be output at each time increment; time history output can optionally be written to an attached plot file which can be post processed for plotting or other purposes; and state vectors can optionally be saved for interface and internal loads calculations (SII3). In addition, provision has been made for coded flags to be issued automatically with the interactive output when specific dynamic conditions are encountered by or are in effect for a given component.

1.4.3 SII3 - Component Interface and Internal Loads. SII3 reads the system state vectors saved from a time history solution (STH3, STH4, STR3), derives the component state vectors from the system state vectors, and computes the interface loads (residual forces and moments) acting on component degrees of freedom using the component coefficient matrices. The time history interface loads can optionally be written to an attached plot file which can be post processed for plotting or other purposes. The user also has the option to compute the time history internal loads for certain components. When this option is elected, the component Loads Module, C---L, is called and calculates the internal forces acting on component degrees of freedom (see paragraph 1.2.7).

1.4.4 SFD1 - Frequency Domain, Mobility. SFD1 computes the complex displacement mobility matrix for the constant M, C, and K matrices of a system at specified frequencies. Under the DYSCO 4.0 implementation, the system mobility matrix was output in units of displacement per unit force. Under the DYSCO 4.1 implementation, the user can obtain component degree of freedom, as well as system degree of freedom mobilities as the response due to a unit force at some system degree(s) of freedom and has the option to have output expressed as either displacement/unit force (in./lb, rad/in.-lb) or acceleration/unit force (g/lb). In addition, the output mobilities can optionally be written to an attached plot file which can be post processed for plotting or other purposes.

1.5 GLOBAL REFERENCE SYSTEM

Under the DYSCO 4.1 implementation, a global coordinate system can be defined for a model. This allows gravitational and centrifugal force vectors to be specified for the model and applied in the individual component coordinate systems during time history and trim solutions. The gravitational and centrifugal acceleration vectors are specified in an inertial (fixed) coordinate system and are successively transformed to the global (model) coordinate system and component coordinate systems during a solution. Forces are computed as the products of the component masses and the transformed accelerations.

1.6 USE OF TECHNOLOGY MODULES

In this basic description of the Component and Solution Technology Modules currently included in DYSCO, the major points of difference between the present implementation and the previous one have been presented. Following sections include sample usages of DYSCO Technology Modules and modeling examples.

2.0 DYSCO 4.1 OPERATION

This section is intended as a supplement to the information presented in Sections 1, 2, and 3 of the DYSCO 4.1 User's Manual and is directed at the reader who has become familiarized with those sections. In this section, examples of DYSCO operation on the IBM 4341 computer under the CMS operating system will be presented. File assignment, examples of the use of the currently installed Technology Modules, and modeling examples and solutions will be presented and discussed.

2.1 PRELIMINARY PROCEDURES

2.1.1 Beginning Execution. On the IBM, the name of the EXEC file which will prompt the user for file information and execute DYSCO is specified at the CMS level. On a VAX, the program is executed using the VMS RUN command and specifying the program name assigned to DYSCO. File assignments are then requested from the user.

2.1.2 File Assignments. File assignments on the IBM are made by responding to the following JCL prompts. Although a different procedure is used to make file assignments on the VAX, the associated prompts are similar. Only required input (based on previous input) is requested.

NUMBER OF DIRECT ACCESS USER FILES?
(Enter the number of User Data Files which will be assigned)

-NAME- OF FILE UNIT Un?
(Enter the first part of the full file name of the nth User Data File; these files are referenced in DYSCO by the names U1, U2, etc., and can be files previously created by DYSCO or new files which will be initialized)

NUMBER OF SEQUENTIAL FILES?
(Enter the number of Sequential Files which will be assigned)

ENTER -NAME- -FILETYPE- -FILEMODE- OF Sn
(Enter the full file name of the nth Sequential File; these files are referenced in DYSCO by the names S1, S2, etc., and may contain airfoil or induced velocity tables in formats consistent with requirements given in Volume II)

NUMBER OF PLOT FILES?
(Enter the number of Plot Files which will be assigned)

-NAME- OF IPLOTn?
(Enter the first part of the full file name of the nth Plot File; these files are referenced in DYSCO by the names IPLOT1, IPLOT2, etc.)

LOAD FILE REQUIRED (Y/N)
(Enter Y [yes] if a Loads File is to be assigned, else N [no]; this file is referenced in DYSCO by the name ILOAD)

At this time, the Run Data File and the Utility File are also defined and the Run Data File is initialized. The Run Data File, the Loads File, and the Utility File are erased at the end of DYSCO execution.

After the file assignments have been made, program execution begins (IBM), and the user is given the option to initialize the User Data Files.

USER FILE Un TO BE INITIALIZED (Y OR N)
(The user can initialize new or previously created user files; all data on a previously created file is destroyed if the file is reinitialized)

DESCRIPTION (24 CHAR) OF Un
(If the nth User Data File is to be initialized, the user is asked to provide a 24-character description which will be used to label the file)

VERIFY Un TO BE INITIALIZED (Y OR N)
(The user is asked to reiterate that the nth User Data File is to be initialized - in case the user has inadvertently chosen to initialize an existing file)

If a new User Data File is not initialized, an error will result, and execution will be aborted.

Following file assignment and initialization, if necessary, the program issues a COMMAND prompt and the user may proceed. In the example in Figure 1, the file assignments are made for two previously created User Data Files. (R;) indicates CMS command level and DYSA is the EXEC file which contains the file assignment prompts. (MORE...) and (VM READ) are screen prompts from the CMS operating system.

2.1.3 The Data Base. Once the COMMAND level has been reached and if files created during previous DYSCO execution have been assigned, the user may wish to survey the current data base using the TOC (Table of Contents) command. The data base for the files assigned in the previous example are shown in Figure 2. TOC has been used to print the complete contents of the Run Data File (R) and the two User Data Files (U1, U2). Asterisks have been entered in response to the TOC prompts in order to search all files for all data sets and data members. The Run Data File remains empty unless the user adds data (ds/dm) to it. The user can also limit the search to a single ds/dm on a given file (Figure 3) or use * in combination with specific responses to perform specific searches.

Each component or force ds/dm has associated with it a sequentially numbered list of variables which have values. These values are specific to the particular component or force usage (ds/dm), but the variable list is part of the full list of variables which can exist for the data member. The LIST command allows the contents of a ds/dm to be listed. Two different usages of the same data member are shown in Figures 4 and 5.

A model ds/dm consists of a sequentially numbered list of component data sets. Within this model list, a component may have associated with it a force data set and any auxiliary ds/dm's (such as an airfoil table) which are required. When a component includes automatically assigned degree of freedom names, the

```
R;
DYSA
     ***************************************
            D Y S C O  4.1  -  SETUP
     ***************************************

NUMBER OF DIRECT ACCESS USER FILES ?
2
     ********************************************************
        ALL REFERENCES TO THESE FILES ARE OF THE FORM
                       U1  U2  U3  U4
     ********************************************************

-NAME- OF FILE U1 ?
ATL2
-NAME- OF FILE U2 ?
PACOSS

NUMBER OF SEQUENTIAL FILES ?
0

NUMBER OF PLOT FILES?
                                                          MORE...
0

LOAD FILE REQUIRED? (Y/N)
N
EXECUTION BEGINS...
USER FILE U1 TO BE INITIALIZED (Y OR N)
N
USER FILE U2 TO BE INITIALIZED (Y OR N)
N
COMMAND
                                                          VM READ
```

Figure 1. Example File Assignments.

```
COMMAND
TOC
FILE (* FOR ALL)
*
DATA SET (* FOR ALL)
*
DATA MEMBER (* FOR ALL)
*

************TABLE OF CONTENTS SEARCH FOR *       /*       ********
           FILE R    ON UNIT 13     RUN DATA FILE

NULL FILE


************TABLE OF CONTENTS SEARCH FOR *       /*       ********
           FILE U1   ON UNIT  1     BLADE DAMAGE

B2Z1T2  /CRE3      ELASTIC ROTOR WITH 2 OP, 1 IP, 2 TOR MODES
FCT1.65 /FRA3      GENERAL AERO, INDUCED VEL 1.65
                                                             MORE..
8300-4  /CFM2      8300 LB AH1G, HUB (-.68, 96.485)
COUPLE  /CLC1      TEETERING CONSTRAINT, CHANGE DEFLECTIONS FROM
                   RADIANS TO INCHES
AH1G16.5/FFC2      AH1G, 16.5 SQ FT FLAT PLATE DRAG
AFD161  /AIRFOIL       B540/V0012     BELL DATA    50A/10MN
3000    /CCE0      CONTROL ROD STIFFNESS 3000 LB/IN
AH1GD   /CRE3      ELASTIC ROTOR WITH 2 OP, 1 IP, 2 TOR MODES
AH1GDB  /MODEL     AH1G TRIM WITH 1 LB REMOVED FROM BLADE TIPS
AH1GDA  /MODEL     AH1G TRIM WITH 1 LB REMOVED FROM BLADE TIPS
DUMMY   /CRD3      DUMMY COMPONENT
BASE    /MODEL
DUMMY   /MODEL
AH1GD   /CRD3      REMOVE 1 LB FROM BLADE TIPS
AH1G-35A/MODEL     AH1G TRIM


************TABLE OF CONTENTS SEARCH FOR *       /*       ********
           FILE U2   ON UNIT  2     FACOSS STRUCTURE

VERT1   /CLC2      COUPLE VERTICAL AND HORIZONTAL MEMBERS
VERT2   /CLC2      COUPLE VERTICAL AND HORIZONTAL MEMBERS
                                                             MORE..
```

Figure 2. Example Complete Table of Contents (TOC).

```
VERT3    /CLC2      COUPLE VERTICAL AND HORIZONTAL MEMBERS
VERT4    /CLC2      COUPLE VERTICAL AND HORIZONTAL MEMBERS
HORIZ    /CSF1      COUPLED DIAGONAL AND HORIZONTAL MEMBERS
MASS     /CSF1      LUMPED MASSES
VERT     /CFM2      1.5 X 1.5 ALUMINUM TUBE, 1/8 WALL, 240 LONG
PACOSS1 /MODEL      PACOSS STRUCTURE SEGMENT 1

COMMAND
```

Figure 2. Example Complete Table of Contents (TOC) (continued)

```
TOC
FILE (* FOR ALL)
U1
DATA SET (* FOR ALL)
8300-4
DATA MEMBER (* FOR ALL)
CFM2

************TABLE OF CONTENTS SEARCH FOR 8300-4  /CFM2     ********
            FILE U1   ON UNIT  1     BLADE DAMAGE

8300-4  /CFM2     8300 LB AH1G, HUB (-.68, 96.485)

COMMAND
```

Figure 3. Example Partial Table of Contents (TOC).

```
LIST
DATA SET
8300-4
DATA MEMBER
CFM2
8300-4   /CFM2      ON FILE U1


***************        8300-4   /CFM2       ***************

8300 LB AH1G, HUB (-.68, 96.485)

*****************************************************************
INPUT FOR STRUCTURAL     COMPONENT CFM2. MODAL FUSELAGE

  1 RBM       - RIGID BODY MODES     =          YES
  2 IXCG      - LONGITUDINAL         =          YES
  3 IYCG      - LATERAL              =          NO
  4 IZCG      - VERTICAL             =          YES
  5 IROLL     - ROLL                 =          YES
  6 IPTCH     - PITCH                =          YES
  7 IYAW      - YAW                  =          NO
                                                                 MORE..
  8 CG        - CG STATION (IN)      =   0.00000E+00
  9 NMODE     - NO. OF ELASTIC MODES=              0
 10 NR        - NO. OF ROTORS        =              1
 11 NROT      - ROTOR NUMBERS        =              1
 12 XROT      - ROTOR STATIONS       =  -6.80000E-01
 13 ZROT      - ROTOR VERTICAL HT    =   9.64850E+01
 14 ASF       - FWD SHAFT ANGLE      =   0.00000E+00
 15 ASL       - LAT SHAFT ANGLE      =   0.00000E+00
 16 IX        - HUB TRAN DOF - LONG =           YES
 17 IY        - HUB TRAN DOF - LAT   =          NO
 18 IZ        - HUB TRAN DOF - AXIAL=           YES
 19 IAX       - HUB ANGL DOF - ROLL =           YES
 20 IAY       - HUB ANGL DOF - PITCH=           YES
 21 IAZ       - HUB ANGL DOF - YAW   =          NO
 22 NI        - NO. OTHER IMPLCT DOF=              0
 23 MASSL     - FUSELAGE MASS  (LB) =   7.29140E+03
 24 IMXF      - ROLL MOI SLUG-FT(SQ)=   3.00000E+03
 25 IMYF      - PITCH MOI ABOUT CG   =   8.00000E+03
*****************************************************************


LIST COMPLETE
COMMAND
```

Figure 4. Example LIST 1.

```
LIST
DATA SET
VERT
DATA MEMBER
CFM2
VERT    /CFM2     ON FILE U2


***************       VERT    /CFM2       ***************

1.5 X 1.5 ALUMINUM TUBE, 1/8 WALL, 240 LONG

*****************************************************************
INPUT FOR STRUCTURAL     COMPONENT CFM2. MODAL FUSELAGE

  1 RBM       - RIGID BODY MODES     =          YES
  2 IXCG      - LONGITUDINAL         =          NO
  3 IYCG      - LATERAL              =          YES
  4 IZCG      - VERTICAL             =          YES
  5 IROLL     - ROLL                 =          NO
  6 IPTCH     - PITCH                =          YES
  7 IYAW      - YAW                  =          YES
                                                              MORE.
  8 CG        - CG STATION (IN)      =  1.20000E+02
  9 NMODE     - NO. OF ELASTIC MODES=             6
 10 NS        - NO. FUSELAGE STAS    =            5
 11 X         - (REAL) INPUT STATION VALUES
               0.00000E+00  6.00000E+01  1.20000E+02  1.80000E+02
               2.40000E+02
 12 VC1       - MODE1 VERTICAL COMP =           YES
 13 Z1        - (REAL) MODE1 VERTICAL DISP
               2.00000E+00 -1.98400E-01 -1.21560E+00 -1.98400E-01
               2.00000E+00
 14 ZP1       - (REAL) MODE1 VERTICAL SLOPE
              -3.87270E-02  0.00000E+00  0.00000E+00  0.00000E+00
               3.87270E-02
 15 LC1       - MODE1 LATERAL COMP   =          NO
 16 TC1       - MODE1 TORSION COMP   =          NO
 17 VC2       - MODE2 VERTICAL COMP =           YES
 18 Z2        - (REAL) MODE2 VERTICAL DISP
               2.00000E+00 -1.16940E+00  0.00000E+00  1.16940E+00
              -2.00000E+00
 19 ZP2       - (REAL) MODE2 VERTICAL SLOPE
              -6.54940E-02  0.00000E+00  0.00000E+00  0.00000E+00
              -6.54940E-02
                                                              MORE.
```

Figure 5. Example LIST 2.

```
20 LC2        - MODE2 LATERAL COMP  =        NO
21 TC2        - MODE2 TORSION COMP  =        NO
22 VC3        - MODE3 VERTICAL COMP =        YES
23 Z3         - (REAL) MODE3 VERTICAL DISP
              2.00000E+00 -1.24220E+00  1.42240E+00 -1.24220E+00
              2.00000E+00
24 ZP3        - (REAL) MODE3 VERTICAL SLOPE
             -9.16270E-02  0.00000E+00  0.00000E+00  0.00000E+00
              9.16270E-02
25 LC3        - MODE3 LATERAL COMP  =        NO
26 TC3        - MODE3 TORSION COMP  =        NO
27 VC4        - MODE4 VERTICAL COMP =        NO
28 LC4        - MODE4 LATERAL COMP  =        YES
29 Y4         - (REAL) MODE4 LATERAL DISP
              2.00000E+00 -1.98400E-01 -1.21560E+00 -1.98400E-01
              2.00000E+00
30 YP4        - (REAL) MODE4 LATERAL SLOPE
             -3.87270E-02  0.00000E+00  0.00000E+00  0.00000E+00
              3.87270E-02
31 TC4        - MODE4 TORSION COMP  =        NO
32 VC5        - MODE5 VERTICAL COMP =        NO
33 LC5        - MODE5 LATERAL COMP  =        YES
                                                           MORE..
34 Y5         - (REAL) MODE5 LATERAL DISP
              2.00000E+00 -1.16940E+00  0.00000E+00  1.16940E+00
             -2.00000E+00
35 YP5        - (REAL) MODE5 LATERAL SLOPE
             -6.54940E-02  0.00000E+00  0.00000E+00  0.00000E+00
             -6.54940E-02
36 TC5        - MODE5 TORSION COMP  =        NO
37 VC6        - MODE6 VERTICAL COMP =        NO
38 LC6        - MODE6 LATERAL COMP  =        YES
39 Y6         - (REAL) MODE6 LATERAL DISP
              2.00000E+00 -1.24220E+00  1.42240E+00 -1.24220E+00
              2.00000E+00
40 YP6        - (REAL) MODE6 LATERAL SLOPE
             -9.16270E-02  0.00000E+00  0.00000E+00  0.00000E+00
              9.16270E-02
41 TC6        - MODE6 TORSION COMP  =        NO
42 NR         - NO. OF ROTORS       =          0
43 NI         - NO. OTHER IMPLCT DOF=          0
44 MASSL      - FUSELAGE MASS  (LB) =  1.58430E+01
45 IMYF       - PITCH MOI ABOUT CG  =  1.64010E+01
46 IMZF       - YAW   MOI ABOUT CG  =  1.64010E+01
47 MMS        - (REAL) MODAL MASS (SLUGS)
                                                           MORE..
```

Figure 5. Example LIST 2 (continued)

```
                4.92030E-01  4.92030E-01  4.92030E-01  4.92030E-01
                4.92030E-01  4.92030E-01
  48 MD         - (REAL) MODAL DAMPING (PCT)
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00
  49 FREQ       - (REAL) MODAL FREQUENCY (HZ)
                7.09000E+00  1.95500E+01  3.83300E+01  7.09000E+00
                1.95500E+01  3.83300E+01
*****************************************************************


LIST COMPLETE
COMMAND
```

Figure 5. Example LIST 2 (continued)

user must supply a component structure or rotor number to distinguish them from the degrees of freedom formed by other uses of the same component in the model. Structure and rotor numbers must be unique in a given model, except in the cases of rotor control systems and damaged rotors. The component input (ds/C---) and the force input (ds/F---) for a given model must exist on the data base before a solution can be performed. Global variables, if any, follow the component/force ds/dm list. Two models are shown in Figures 6 and 7. The component rotor or structure number is found in the column labeled (NO.). Note that in the second example, VERT/CFM2 is used 4 times and in the first example, B2Z1T2/CRE3 and 3000/CCEØ have been assigned to rotor 1 and 8300-4/CFM2 has been assigned to structure 1.

```
LIST
DATA SET
AH1G-35A
DATA MEMBER
MODEL
AH1G-35A/MODEL     ON FILE U1

************************      MODEL AH1G-35A   *******************

AH1G TRIM

INDEX    COMP     NO.    DATA SET          FORCE    DATA SET

  1      CRE3      1     B2Z1T2            FRA3     FCT1.65
                                      REQUIRED DS/DM= AFD161   /AIRFOIL
  2      CCE0      1     3000              NONE
  3      CLC1            COUPLE            NONE
  4      CFM2      1     8300-4            FFC2     AH1G16.5

******************************************************************

                                                           MORE..
******************************************************************
                                 GLOBAL  VARIABLES

  1 VSOUND    - SOUND VELOCITY      =  1.13800E+03
  2 RHO       - AIR DENSITY RATIO   =  8.79000E-01
******************************************************************


LIST COMPLETE
COMMAND
```

Figure 6. Example Model 1.

```
LIST
DATA SET
PACOSS1
DATA MEMBER
MODEL
PACOSS1 /MODEL    ON FILE U2

************************     MODEL PACOSS1    *******************

PACOSS STRUCTURE SEGMENT 1

INDEX    COMP    NO.    DATA SET           FORCE    DATA SET

  1      CSF1           HORIZ              NONE
  2      CFM2     1     VERT               NONE
  3      CFM2     2     VERT               NONE
  4      CFM2     3     VERT               NONE
  5      CFM2     4     VERT               NONE
  6      CLC2           VERT1              NONE
  7      CLC2           VERT2              NONE
  8      CLC2           VERT3              NONE
                                                             MORE..
  9      CLC2           VERT4              NONE
 10      CSF1           MASS               NONE

*****************************************************************

*****************************************************************
                             GLOBAL  VARIABLES

 NO INPUT REQUIRED
*****************************************************************


LIST COMPLETE
COMMAND
```

Figure 7. Example Model 2.

2.2 COMPONENT DATA SETS

Input data for a component is formed using the NEW command or its variations (new data sets may be input during model formulation and the addition phase of model editing) or by editing an existing component data set. In the examples which follow, the NEW command has been used to form sample data sets. The user should refer directly to paragraph 3.1 of the DYSCO 4.1 User's Manual while reviewing the sample dialogues.

2.2.1 CFM2 - Fuselage Modal.

2.2.1.1 CFM2 User Notes - The user must supply modes from a separate analysis and the modes are assumed to be orthogonal, but it is not necessary to specify enough stations to totally define a mode shape. Mode shapes need only be defined such that if modal interpolation is required (implicit degrees of freedom), adequate definition has been made, or the user can simply define mode shapes at stations that coincide with implicit degree of freedom locations.

Modes can be obtained from test data, from some outside analysis, or by formulating a finite element model using DYSCO (CSF1) and performing an eigenanalysis of the system. The mode shapes, frequency, and damping obtained can be used for the modal representation. There are no limitations on the mode shapes, except that they be consistent for all modes, and that, if modal slopes are required (modal coupling), consistency be maintained.

2.2.1.2 CFM2 Sample Input - Inputs for two CFM2 data sets follow. In the first example, a fuselage with two rigid body modes and one elastic mode is considered. The elastic mode is defined in the vertical direction and modal displacements and slopes are input for five stations.

In the second example, a rigid fuselage with a rotor attached is considered. Since there are no elastic degrees of freedom, no fuselage stations are required. The rotor may be rigid or elastic. Only the location and orientation of the hub degrees of freedom with respect to the fuselage are required.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CFM2
DATA SET
BEAM
SAVE FILE(R,U1,...)
U1


STRUCTURAL COMPONENT CFM2 . MODAL FUSELAGE

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
MODAL BEAM
------
RBM       (Y OR N)
    RIGID BODY MODES
ENTER 1 Y OR N VALUE
Y
------
                                                                MORE...
IXCG      (Y OR N)
    LONGITUDINAL
ENTER 1 Y OR N VALUE
N
------
IYCG      (Y OR N)
    LATERAL
ENTER 1 Y OR N VALUE
N
------
IZCG      (Y OR N)
    VERTICAL
ENTER 1 Y OR N VALUE
Y
------
IROLL     (Y OR N)
    ROLL
ENTER 1 Y OR N VALUE
N
------
IPTCH     (Y OR N)
    PITCH
                                                                MORE...
```

```
ENTER 1 Y OR N VALUE
Y
-----
IYAW      (Y OR N)
    YAW
ENTER 1 Y OR N VALUE
N
-----
CG        (REAL)
    CG STATION (IN)
ENTER 1 REAL VALUE
?
120
-----
NMODE     (INTEGER)
    NO. OF ELASTIC MODES
ENTER    1 INTEGER VALUE(S)
1
-----
NS        (INTEGER)
    NO. FUSELAGE STAS
ENTER    1 INTEGER VALUE(S)
                                                            MORE...
5
-----
X         (REAL)
    INPUT STATION VALUES
ENTER  5 REAL VALUE(S)
?
0 120 240 360 480
-----
VC1       (Y OR N)
    MODE1 VERTICAL COMP
ENTER 1 Y OR N VALUE
Y
-----
Z1        (REAL)
    MODE1 VERTICAL DISP
NULL VECTOR (Y OR N)
N
ENTER  5 REAL VALUE(S)
?
1 -.2 -1.2 -.2 1
-----
ZP1       (REAL)
                                                            MORE...
```

```
    MODE1 VERTICAL SLOPE
NULL VECTOR (Y OR N)
N
ENTER  5 REAL VALUE(S)
?
-.01 -.005 0 .005 .01
-----
LC1       (Y OR N)
    MODE1 LATERAL COMP
ENTER 1 Y OR N VALUE
N
-----
TC1       (Y OR N)
    MODE1 TORSION COMP
ENTER 1 Y OR N VALUE
N
-----
NR        (INTEGER)
    NO. OF ROTORS
ENTER     1 INTEGER VALUE(S)
0
-----
                                                                  MORE...
NI        (INTEGER)
    NO. OTHER IMPLCT DOF
ENTER     1 INTEGER VALUE(S)
0
-----
MASSL     (REAL)
    FUSELAGE MASS  (LB)
ENTER 1 REAL VALUE
?
3000
-----
IMYF      (REAL)
    PITCH MOI ABOUT CG
ENTER 1 REAL VALUE
?
3000
-----
MMS       (REAL)
    MODAL MASS (SLUGS)
ENTER  1 REAL VALUE(S)
?
50
                                                                  MORE...
```

```
-----
MD        (REAL)
    MODAL DAMPING (PCT)
ENTER  1 REAL VALUE(S)
?
5
-----
FREQ      (REAL)
    MODAL FREQUENCY (HZ)
ENTER  1 REAL VALUE(S)
?
10
***************************************************************************
INPUT FOR STRUCTURAL     COMPONENT CFM2. MODAL FUSELAGE

  1 RBM       - RIGID BODY MODES     =          YES
  2 IXCG      - LONGITUDINAL         =          NO
  3 IYCG      - LATERAL              =          NO
  4 IZCG      - VERTICAL             =          YES
  5 IROLL     - ROLL                 =          NO
  6 IPTCH     - PITCH                =          YES
  7 IYAW      - YAW                  =          NO
                                                                  MORE...
  8 CG        - CG STATION (IN)      =  1.20000E+02
  9 NMODE     - NO. OF ELASTIC MODES=              1
 10 NS        - NO. FUSELAGE STAS    =             5
 11 X         - (REAL) INPUT STATION VALUES
               0.00000E+00  1.20000E+02  2.40000E+02  3.60000E+02
               4.80000E+02
 12 VC1       - MODE1 VERTICAL COMP =           YES
 13 Z1        - (REAL) MODE1 VERTICAL DISP
               1.00000E+00 -2.00000E-01 -1.20000E+00 -2.00000E-01
               1.00000E+00
 14 ZP1       - (REAL) MODE1 VERTICAL SLOPE
              -1.00000E-02 -5.00000E-03  0.00000E+00  5.00000E-03
               1.00000E-02
 15 LC1       - MODE1 LATERAL COMP   =          NO
 16 TC1       - MODE1 TORSION COMP   =          NO
 17 NR        - NO. OF ROTORS        =             0
 18 NI        - NO. OTHER IMPLCT DOF=              0
 19 MASSL     - FUSELAGE MASS  (LB) =  3.00000E+03
 20 IMYF      - PITCH MOI ABOUT CG   =  3.00000E+03
 21 MMS       - MODAL MASS (SLUGS)   =  5.00000E+01
 22 MD        - MODAL DAMPING (PCT) =  5.00000E+00
 23 FREQ      - MODAL FREQUENCY (HZ)=  1.00000E+01
                                                                  MORE...
```

```
***********************************************************************

RE-ENTER (Y OR N)
N
DATA SET BEAM      FOR CFM2 SAVED ON U1
COMPONENT, FORCE, OR N
CFM2
DATA SET
FUSLAT
SAVE FILE(R,U1,...)
U1


STRUCTURAL COMPONENT CFM2 . MODAL FUSELAGE

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
RIDID FUSELAGE WITH LATERAL DOF
-----
RBM       (Y OR N)
    RIGID BODY MODES
ENTER 1 Y OR N VALUE
                                                                MORE...
Y
-----
IXCG      (Y OR N)
    LONGITUDINAL
ENTER 1 Y OR N VALUE
N
-----
IYCG      (Y OR N)
    LATERAL
ENTER 1 Y OR N VALUE
Y
-----
IZCG      (Y OR N)
    VERTICAL
ENTER 1 Y OR N VALUE
N
-----
IROLL     (Y OR N)
    ROLL
ENTER 1 Y OR N VALUE
Y
-----
                                                                MORE...
```

```
IPTCH      (Y OR N)
    PITCH
ENTER 1 Y OR N VALUE
N
-----
IYAW       (Y OR N)
    YAW
ENTER 1 Y OR N VALUE
N
-----
NMODE      (INTEGER)
    NO. OF ELASTIC MODES
ENTER     1 INTEGER VALUE(S)
0
-----
NR         (INTEGER)
    NO. OF ROTORS
ENTER     1 INTEGER VALUE(S)
1
-----
NROT       (INTEGER)
    ROTOR NUMBERS
                                                              MORE...
ENTER     1 INTEGER VALUE(S)
1
-----
XROT       (REAL)
    ROTOR STATIONS
ENTER  1 REAL VALUE(S)
?
-9.9
-----
ZROT       (REAL)
    ROTOR VERTICAL HT
ENTER  1 REAL VALUE(S)
?
84.24
-----
ASF        (REAL)
    FWD SHAFT ANGLE
ENTER  1 REAL VALUE(S)
?
6
-----
ASL        (REAL)
                                                              MORE...
```

```
    LAT SHAFT ANGLE
ENTER   1 REAL VALUE(S)
?
4
------
IX         (Y OR N)
    HUB TRAN DOF - LONG
ENTER 1 Y OR N VALUE
N
------
IY         (Y OR N)
    HUB TRAN DOF - LAT
ENTER 1 Y OR N VALUE
Y
------
IZ         (Y OR N)
    HUB TRAN DOF - AXIAL
ENTER 1 Y OR N VALUE
N
------
IAX        (Y OR N)
    HUB ANGL DOF - ROLL
                                                            MORE...
ENTER 1 Y OR N VALUE
Y
------
IAY        (Y OR N)
    HUB ANGL DOF - PITCH
ENTER 1 Y OR N VALUE
N
------
IAZ        (Y OR N)
    HUB ANGL DOF - YAW
ENTER 1 Y OR N VALUE
N
------
NI         (INTEGER)
    NO. OTHER IMPLCT DOF
ENTER      1 INTEGER VALUE(S)
0
------
MASSL      (REAL)
    FUSELAGE MASS  (LB)
ENTER 1 REAL VALUE
?
                                                            VM READ
```

```
12434
-----
IMXF      (REAL)
    ROLL MOI SLUG-FT(SQ)
ENTER 1 REAL VALUE
?
7700
*************************************************************************
INPUT FOR STRUCTURAL      COMPONENT CFM2. MODAL FUSELAGE

  1 RBM       - RIGID BODY MODES     =         YES
  2 IXCG      - LONGITUDINAL         =         NO
  3 IYCG      - LATERAL              =         YES
  4 IZCG      - VERTICAL             =         NO
  5 IROLL     - ROLL                 =         YES
  6 IPTCH     - PITCH                =         NO
  7 IYAW      - YAW                  =         NO
  8 NMODE     - NO. OF ELASTIC MODES=            0
  9 NR        - NO. OF ROTORS        =            1
 10 NROT      - ROTOR NUMBERS        =            1
 11 XROT      - ROTOR STATIONS       = -9.90000E+00
 12 ZROT      - ROTOR VERTICAL HT    =  8.42400E+01
                                                          MORE...
 13 ASF       - FWD SHAFT ANGLE      =  6.00000E+00
 14 ASL       - LAT SHAFT ANGLE      =  4.00000E+00
 15 IX        - HUB TRAN DOF - LONG =          NO
 16 IY        - HUB TRAN DOF - LAT   =         YES
 17 IZ        - HUB TRAN DOF - AXIAL=          NO
 18 IAX       - HUB ANGL DOF - ROLL =          YES
 19 IAY       - HUB ANGL DOF - PITCH=          NO
 20 IAZ       - HUB ANGL DOF - YAW   =         NO
 21 NI        - NO. OTHER IMPLCT DOF=             0
 22 MASSL     - FUSELAGE MASS  (LB) =  1.24340E+04
 23 IMXF      - ROLL MOI SLUG-FT(SQ)=  7.70000E+03
*************************************************************************

RE-ENTER (Y OR N)
N
DATA SET FUSLAT   FOR CFM2 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
                                                          VM READ
```

2.2.2 CRR2 - Rotor, Rigid Blades.

2.2.2.1 CRR2 User Notes - Rotor system analyses which include rotors with rigid blades should generally be limited to trim and performance estimates. Limited damage assessment and some stability analyses, such as ground resonance modeling, can also be performed.

2.2.2.2 CRR2 Sample Input - Input is shown for a CRR2 data set which could be used in a limited ground resonance analysis. Degrees of freedom have been chosen so that motion is confined to the lateral direction.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CRR2
DATA SET
ROTLAT
SAVE FILE(R,U1,...)
U1

ROTOR COMPONENT CRR2 . ROTOR RIGID BLADES

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
RIGID ROTOR WITH LATERAL DOF
-----
IBETA    (Y OR N)
    BLADE FLAPPING DOF
    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * **
    *                                                              *
    *  BLADE MUST HAVE AT LEAST ONE OF FLAP, LAG OR PITCH DOF      *
                                                            MORE...
    *                                                              *
    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * **
ENTER 1 Y OR N VALUE
N
-----
IZETA    (Y OR N)
    BLADE LAG DOF
ENTER 1 Y OR N VALUE
Y
-----
ITHET    (Y OR N)
    BLADE PITCH DOF
ENTER 1 Y OR N VALUE
N
-----
IX       (Y OR N)
    HUB TRAN DOF - LONG
ENTER 1 Y OR N VALUE
N
-----
IY       (Y OR N)
    HUB TRAN DOF - LAT
                                                            MORE...
```

```
ENTER 1 Y OR N VALUE
Y
-----
IZ        (Y OR N)
    HUB TRAN DOF - AXIAL
ENTER 1 Y OR N VALUE
N
-----
IAX       (Y OR N)
    HUB ANGL DOF - ROLL
ENTER 1 Y OR N VALUE
Y
-----
IAY       (Y OR N)
    HUB ANGL DOF - PITCH
ENTER 1 Y OR N VALUE
N
-----
IAZ       (Y OR N)
    HUB ANGL DOF - YAW
ENTER 1 Y OR N VALUE
N
                                                              MORE...
-----
NB        (INTEGER)
    NUMBER OF BLADES
ENTER    1 INTEGER VALUE(S)
4
-----
R         (REAL)
    ROTOR RADIUS
ENTER 1 REAL VALUE
?
283.45
-----
RPM       (REAL)
    ROTOR RPM
ENTER 1 REAL VALUE
?
309.4
-----
IC        (INTEGER)
    ROTOR ROTATION
    -1 IS CLOCKWISE; +1 IS CNTRCLOCKWISE
ENTER    1 INTEGER VALUE(S)
                                                              MORE...
```

```
1
-----
PSI       (REAL)
    AZIMUTH OF REF BLADE
    AZIMUTH OF REFERENCE BLADE AT T = 0
ENTER 1 REAL VALUE
?
0
-----
E1        (REAL)
    HINGE OFFSET
ENTER 1 REAL VALUE
?
8.25
-----
CZETA     (REAL)
    LAG DAMPER VALUE
ENTER 1 REAL VALUE
?
628
-----
KZETA     (REAL)
                                                                  MORE...
    LAG  SPRING STIFFNSS
ENTER 1 REAL VALUE
?
10627.2
-----
MHUB      (REAL)
    HUB MASS
ENTER 1 REAL VALUE
?
600.62
-----
IHUBX     (REAL)
    HUB MOI - REF BLADE
    MOMENT OF INERTIA ABOUT REFERENCE BLADE AXIS
ENTER 1 REAL VALUE
?
0
-----
IHUBY     (REAL)
    HUB MOI - PERPENDCLR
    MOMENT OF INERTIA ABOUT PERPENDICULAR AXIS
ENTER 1 REAL VALUE
                                                                  MORE...
```

```
?
0
-----
THO       (REAL)
    ROOT PITCH ANGLE
ENTER 1 REAL VALUE
?
0
-----
UB        (Y OR N)
    UNIFORM BLADE
ENTER 1 Y OR N VALUE
Y
-----
UMB       (REAL)
    BLADE MASS/UNIT LNTH
ENTER 1 REAL VALUE
?
.78623
-----
UITH      (REAL)
    TOTAL FEATHERING MOI
                                                             MORE...
ENTER 1 REAL VALUE
?
0
-----
UCG       (REAL)
    C G  OFFSET
    + VALUE IS FWD; - IS AFT
ENTER 1 REAL VALUE
?
0
-----
UTHX      (REAL)
    TOTAL BUILT-IN TWIST
    - VALUE = NOSE DOWN; + VALUE = UP
ENTER 1 REAL VALUE
?
0
-----
NX        (INTEGER)
    NO. OF BLADE STAS.
ENTER    1 INTEGER VALUE(S)
10
                                                             MORE...
```

```
*****************************************************************************
INPUT FOR      ROTOR       COMPONENT CRR2. ROTOR RIGID BLADES

  1 IBETA     - BLADE FLAPPING DOF   =           NO
  2 IZETA     - BLADE LAG DOF        =           YES
  3 ITHET     - BLADE PITCH DOF      =           NO
  4 IX        - HUB TRAN DOF - LONG  =           NO
  5 IY        - HUB TRAN DOF - LAT   =           YES
  6 IZ        - HUB TRAN DOF - AXIAL=            NO
  7 IAX       - HUB ANGL DOF - ROLL  =           YES
  8 IAY       - HUB ANGL DOF - PITCH=            NO
  9 IAZ       - HUB ANGL DOF - YAW   =           NO
 10 NB        - NUMBER OF BLADES     =              4
 11 R         - ROTOR RADIUS         =  2.83450E+02
 12 RPM       - ROTOR RPM            =  3.09400E+02
 13 IC        - ROTOR ROTATION       =              1
 14 PSI       - AZIMUTH OF REF BLADE=   0.00000E+00
 15 E1        - HINGE OFFSET         =  8.25000E+00
 16 CZETA     - LAG DAMPER VALUE     =  6.28000E+02
 17 KZETA     - LAG  SPRING STIFFNSS=   1.06272E+04
 18 MHUB      - HUB MASS             =  6.00620E+02
 19 IHUBX     - HUB MOI - REF BLADE =   0.00000E+00
                                                            MORE...
 20 IHUBY     - HUB MOI - PERPENDCLR=   0.00000E+00
 21 THO       - ROOT PITCH ANGLE     =  0.00000E+00
 22 UB        - UNIFORM BLADE        =           YES
 23 UMB       - BLADE MASS/UNIT LNTH=   7.86230E-01
 24 UITH      - TOTAL FEATHERING MOI=   0.00000E+00
 25 UCG       - C G  OFFSET          =  0.00000E+00
 26 UTHX      - TOTAL BUILT-IN TWIST=   0.00000E+00
 27 NX        - NO. OF BLADE STAS.   =             10
*****************************************************************************

RE-ENTER (Y OR N)
N
DATA SET ROTLAT   FOR CRR2 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
                                                            VM READ
```

2.2.3 CRE3 - Rotor, Elastic Blades.

2.2.3.1 CRE3 User Notes - The user should carefully review the Theoretical Manual and the User's Manual prior to formulating an elastic rotor simulation using CRE3.

CRE3 can be substituted into any rotor system analysis using CRR2 and can be used in conjunction with CRD3 to perform detailed rotor blade damage assessments. In addition, the user can set "switches" which will allow time history blade moments to be calculated (SII3).

2.2.3.2 CRE3 Sample Input - Input is shown for a CRE3 data set which could be used in a limited ground resonance analysis. Degrees of freedom have been chosen so that motion is confined to the lateral direction, and one rigid and one elastic in-plane blade degree of freedom have been input. Note that even though only in-plane blade degrees of freedom have been specified, in-plane and out-of-plane stiffnesses are required due to in-plane, out-of-plane coupling and, as a result, in-plane and out-of-plane moments are generated.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CRE3
DATA SET
ROTLAT
SAVE FILE(R,U1,...)
U1

ROTOR COMPONENT CRE3 . ROTOR ELASTIC BLADES

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
ELASTIC ROTOR WITH LATERAL DOF
-----
JV        (Y OR N)
    INPLANE DOF
ENTER 1 Y OR N VALUE
Y
-----
                                                        MORE...
JW        (Y OR N)
    OUTPLANE DOF
ENTER 1 Y OR N VALUE
N
-----
JP        (Y OR N)
    TORSION DOF
ENTER 1 Y OR N VALUE
N
-----
JS        (Y OR N)
    SHAFT PERTURBED DOF
ENTER 1 Y OR N VALUE
N
-----
JX        (Y OR N)
    XHUB(LONG) DOF
ENTER 1 Y OR N VALUE
N
-----
JY        (Y OR N)
    YHUB(LAT) DOF
                                                        MORE...
```

```
ENTER 1 Y OR N VALUE
Y
-----
JZ        (Y OR N)
    ZHUB(AXIAL) DOF
ENTER 1 Y OR N VALUE
N
-----
JAX       (Y OR N)
    ALFX(ROLL) DOF
ENTER 1 Y OR N VALUE
Y
-----
JAY       (Y OR N)
    ALFY(PTCH) DOF
ENTER 1 Y OR N VALUE
N
-----
JAZ       (Y OR N)
    ALFZ(YAW) DOF
ENTER 1 Y OR N VALUE
N
                                                                 MORE...
-----
NV        (INTEGER)
    NO. OF INPLANE MODES
ENTER     1 INTEGER VALUE(S)
2
-----
NB        (INTEGER)
    NO. OF BLADES
ENTER     1 INTEGER VALUE(S)
2
-----
NX        (INTEGER)
    NO. OF STATIONS
ENTER     1 INTEGER VALUE(S)
20
-----
ITYP      (INTEGER)
    MODE INPUT 1 OR 2
    1 = MODE SHAPE INPUT BY USER2 = MODE SHAPE GENERATED AUTOMATICAL
    LY BASED ON UNIFORM NONROTATING BEAM
ENTER     1 INTEGER VALUE(S)
1
                                                                 MORE...
```

```
-----
X        (REAL)
    STATIONS
ENTER 20 REAL VALUE(S)
?
0 15 45 52.79 52.8 62.9 82.7 101.7 121.5 138.6
?
150.5 163.7 178.2 191.4 205.15 218.35 231.25 245.5 257.4 264
-----
NIP       (INTEGER)
    INPLANE HINGE STA

ENTER    1 INTEGER VALUE(S)
1
-----
VPP       (REAL)
    2ND DERIVATIVE OF IP
     MODES
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
                                                                    MORE...
C
OPTION TO SPECIFY NULL COLUMNS (Y OR N)
Y
NULL COL  1 (Y OR N)
Y
NULL COL  2 (Y OR N)
N
PREPARE TO ENTER COL  2
ENTER 20 REAL VALUES
?
3.6485E-5 9.2447E-5 1.5321E-5 1.4412E-5 1.4412E-5 2.5838E-5 2.2203E-5
?
1.7918E-5 1.61E-5 1.3763E-5 1.2335E-5 1.0257E-5 8.6994E-6 7.0115E-6
?
4.6743E-6 2.8565E-6 1.5581E-6 5.1936E-7 0 0
-----
VP        (REAL)
    1ST DERIVATIVE OF IP
     MODES
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
                                                                    MORE...
```

```
INPUT BY ROWS OR COLUMNS (R OR C)
C
OPTION TO SPECIFY NULL COLUMNS (Y OR N)
N
PREPARE TO ENTER COL  1
ENTER 20 REAL VALUES
?
3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3
?
3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3
?
3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3 3.7878E-3
PREPARE TO ENTER COL  2
ENTER 20 REAL VALUES
?
0 9.67E-4 2.5835E-3 2.6993E-3 2.6995E-3 2.9027E-3 3.3783E-3 3.7595E-3
?
4.0963E-3 4.3516E-3 4.5069E-3 4.656E-3 4.7934E-3 4.9971E-3 4.9775E-3
?
5.0272E-3 5.0556E-3 5.0705E-3 5.0735E-3 5.375E-3
-----
V        (REAL)
                                                                MORE...
    INPLANE MODE SHAPES
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
C
OPTION TO SPECIFY NULL COLUMNS (Y OR N)
N
PREPARE TO ENTER COL  1
ENTER 20 REAL VALUES
?
0 .05681 .17045 .2 .2001 .2382 .31325 .3852 .4602 .525 .57 .62 .675
?
.725 .777 .8271 .8759 .93 .975 1
PREPARE TO ENTER COL  2
ENTER 20 REAL VALUES
?
0 .007252 .06051 .08108 .08111 .1094 .17159 .2394 .3171 .3894 .4421
?
.5025 .5711 .635 .703 .7689 .834 .9061 .9665 1
-----
CIPP     (REAL)
                                                                MORE...
```

```
    IP MODAL DAMPING
    (LBF-SEC/IN)
NULL VECTOR (Y OR N)
Y
-----
NI         (INTEGER)
    NO. OF IMPLICIT DOFS
ENTER     1 INTEGER VALUE(S)
0
-----
KIP        (REAL)
    IP SPRING RATE
    (IN-LBF/DEG)
ENTER 1 REAL VALUE
?
0
-----
CIP        (REAL)
    IP DAMPING RATE
    (IN-LBF-SEC/DEG)
ENTER 1 REAL VALUE
?
                                                          MORE...
0
-----
OM         (REAL)
    RPM
ENTER 1 REAL VALUE
?
324
-----
IC         (INTEGER)
    ROTATION DIRECTION
    1 = COUNTERCLOCKWISE  -1 = CLOCKWISE
ENTER     1 INTEGER VALUE(S)
1
-----
PSI0       (REAL)
    AZIMUTH OF REF BLADE
    AT T=0 (DEG)
ENTER 1 REAL VALUE
?
0
-----
MHUB       (REAL)
                                                          MORE...
```

```
    HUB WEIGHT (LB)
ENTER 1 REAL VALUE
?
0
-----
IHUBX     (REAL)
    HUB M.O.I. ABOUT X-
    AXIS(LB-IN**2)
ENTER 1 REAL VALUE
?
0
-----
THO       (REAL)
    ROOT PTCH ANG (DEG)
ENTER 1 REAL VALUE
?
15
-----
NONLIN    (Y OR N)
    NONLIN TERMS
ENTER 1 Y OR N VALUE
N
                                                          MORE...
-----
IU        (Y OR N)
    UNIFORM BLADE
ENTER 1 Y OR N VALUE
N
-----
M         (REAL)
    MASS PER UNIT LENGTH
    (LB/IN)
NULL VECTOR (Y OR N)
N
ENTER 20 REAL VALUE(S)
?
5.7834 5.7834 5.26 5.26 .89 .89 .82 .8446 .797 .726 .875 1.098
?
1.063 1.039 1.26 1.186 1.266 1.189 1.16 1.16
-----
SE        (REAL)
    CG OFFSET FROM EA
    (IN)
NULL VECTOR (Y OR N)
Y
                                                          MORE...
```

```
-----
SEA       (REAL)
    AREA CENTROID OFFSET
    FROM EA (+ FWD EA) (IN)
NULL VECTOR (Y OR N)
Y
-----
KM1       (REAL)
    MASS ROG ABOUT
    LOCAL CHORDWISE AXIS IN BEAMWISE DIRECTION (IN)
NULL VECTOR (Y OR N)
Y
-----
KM2       (REAL)
    MASS ROG ABOUT
    LOCAL BEAMWISE AXIS IN CHORDWISE DIRECTION (IN)
NULL VECTOR (Y OR N)
Y
-----
KA        (REAL)
    AREA ROG OF CROSS
                                                                  MORE...
    SECTION (IN)
NULL VECTOR (Y OR N)
Y
-----
THP       (REAL)
    PRETWIST RATE DEG/IN
NULL VECTOR (Y OR N)
N
ENTER 20 REAL VALUE(S)
?
-.04 -.04 -.04 -.04 -.04 -.04 -.04 -.04 -.04 -.04
?
-.04 -.04 -.04 -.04 -.04 -.04 -.04 -.04 -.04 -.04
-----
EIY       (REAL)
    CHORDWISE EI*10E-6
    (LBF*IN**2)
NULL VECTOR (Y OR N)
N
ENTER 20 REAL VALUE(S)
?
5000 5000 5000 5000 4240 4240 4150 4290 3820 3600
                                                                  MORE...
```

```
?
3390 3255 2910 2650 2650 2650 2655 2660 2690 2690
-----
EIZ       (REAL)
    BEAMWISE EI*10E-6
    (LBF*IN**2)
NULL VECTOR (Y OR N)
N
ENTER 20 REAL VALUE(S)
?
180 180 300 300 89.5 89.5 58 53 46 40
?
40 41 41 39.6 39.5 42 42.4 42.4 38 38
-----
EA        (REAL)
    SECTION EA*10E-6
    (LBF)
NULL VECTOR (Y OR N)
Y
-----
JIL       (Y OR N)
    INTERNAL LOADS
                                                            MORE...
ENTER 1 Y OR N VALUE
Y
-----
NXIL      (INTEGER)
    NO. OF STATIONS
ENTER     1 INTEGER VALUE(S)
5
-----
INDIL     (INTEGER)
    STATION INDICES
ENTER     5 INTEGER VALUE(S)
1 2 3 4 5
-----
JIPIL     (Y OR N)
    INPLANE MOMENTS
ENTER 1 Y OR N VALUE
Y
-----
JOPIL     (Y OR N)
    OUTPLANE MOMENTS
ENTER 1 Y OR N VALUE
Y
                                                            MORE...
```

```
***************************************************************************
INPUT FOR      ROTOR      COMPONENT CRE3. ROTOR ELASTIC BLADES

  1 JV          - INPLANE DOF           =          YES
  2 JW          - OUTPLANE DOF          =          NO
  3 JP          - TORSION DOF           =          NO
  4 JS          - SHAFT PERTURBED DOF   =          NO
  5 JX          - XHUB(LONG) DOF        =          NO
  6 JY          - YHUB(LAT) DOF         =          YES
  7 JZ          - ZHUB(AXIAL) DOF       =          NO
  8 JAX         - ALFX(ROLL) DOF        =          YES
  9 JAY         - ALFY(PTCH) DOF        =          NO
 10 JAZ         - ALFZ(YAW) DOF         =          NO
 11 NV          - NO. OF INPLANE MODES=              2
 12 NB          - NO. OF BLADES         =              2
 13 NX          - NO. OF STATIONS       =             20
 14 ITYP        - MODE INPUT 1 OR 2     =              1
 15 X           - (REAL) STATIONS
                0.00000E+00  1.50000E+01  4.50000E+01  5.27900E+01
                5.28000E+01  6.29000E+01  8.27000E+01  1.01700E+02
                1.21500E+02  1.38600E+02  1.50500E+02  1.63700E+02
                1.78200E+02  1.91400E+02  2.05150E+02  2.18350E+02
                                                             MORE...
                2.31250E+02  2.45500E+02  2.57400E+02  2.64000E+02
 16 NIP         - INPLANE HINGE STA     =              1
 17 VPP         - (REAL) 2ND DERIVATIVE OF IP
              GENERAL MATRIX

    ROW      1
             0.00000E+00  3.64850E-05
    ROW      2
             0.00000E+00  9.24470E-05
    ROW      3
             0.00000E+00  1.53210E-05
    ROW      4
             0.00000E+00  1.44120E-05
    ROW      5
             0.00000E+00  1.44120E-05
    ROW      6
             0.00000E+00  2.58380E-05
    ROW      7
             0.00000E+00  2.22030E-05
    ROW      8
             0.00000E+00  1.79180E-05
    ROW      9
                                                             MORE...
```

```
          0.00000E+00  1.61000E-05
   ROW    10
          0.00000E+00  1.37630E-05
   ROW    11
          0.00000E+00  1.23350E-05
   ROW    12
          0.00000E+00  1.02570E-05
   ROW    13
          0.00000E+00  8.69940E-06
   ROW    14
          0.00000E+00  7.01150E-06
   ROW    15
          0.00000E+00  4.67430E-06
   ROW    16
          0.00000E+00  2.85650E-06
   ROW    17
          0.00000E+00  1.55810E-06
   ROW    18
          0.00000E+00  5.19360E-07
   ROW    19      NULL ROW
   ROW    20      NULL ROW
18 VP         - (REAL) 1ST DERIVATIVE OF IP
                                                          MORE...
           GENERAL MATRIX

   ROW     1
          3.78780E-03  0.00000E+00
   ROW     2
          3.78780E-03  9.67000E-04
   ROW     3
          3.78780E-03  2.58350E-03
   ROW     4
          3.78780E-03  2.69930E-03
   ROW     5
          3.78780E-03  2.69950E-03
   ROW     6
          3.78780E-03  2.90270E-03
   ROW     7
          3.78780E-03  3.37830E-03
   ROW     8
          3.78780E-03  3.75950E-03
   ROW     9
          3.78780E-03  4.09630E-03
   ROW    10
          3.78780E-03  4.35160E-03
                                                          MORE...
```

```
ROW      11
         3.78780E-03   4.50690E-03
ROW      12
         3.78780E-03   4.65600E-03
ROW      13
         3.78780E-03   4.79340E-03
ROW      14
         3.78780E-03   4.99710E-03
ROW      15
         3.78780E-03   4.97750E-03
ROW      16
         3.78780E-03   5.02720E-03
ROW      17
         3.78780E-03   5.05560E-03
ROW      18
         3.78780E-03   5.07050E-03
ROW      19
         3.78780E-03   5.07350E-03
ROW      20
         3.78780E-03   5.37500E-03
19 V          - (REAL) INPLANE MODE SHAPES
          GENERAL MATRIX
                                                        MORE...

ROW       1      NULL ROW
ROW       2
         5.68100E-02   7.25200E-03
ROW       3
         1.70450E-01   6.05100E-02
ROW       4
         2.00000E-01   8.10800E-02
ROW       5
         2.00100E-01   8.11100E-02
ROW       6
         2.38200E-01   1.09400E-01
ROW       7
         3.13250E-01   1.71590E-01
ROW       8
         3.85200E-01   2.39400E-01
ROW       9
         4.60200E-01   3.17100E-01
ROW      10
         5.25000E-01   3.89400E-01
ROW      11
         5.70000E-01   4.42100E-01
                                                        MORE...
```

```
   ROW     12
           6.20000E-01  5.02500E-01
   ROW     13
           6.75000E-01  5.71100E-01
   ROW     14
           7.25000E-01  6.35000E-01
   ROW     15
           7.77000E-01  7.03000E-01
   ROW     16
           8.27100E-01  7.68900E-01
   ROW     17
           8.75900E-01  8.34000E-01
   ROW     18
           9.30000E-01  9.06100E-01
   ROW     19
           9.75000E-01  9.66500E-01
   ROW     20
           1.00000E+00  1.00000E+00
20 CIPP       - IP MODAL DAMPING      =  0.00000E+00  0.00000E+00
21 NI         - NO. OF IMPLICIT DOFS=            0
22 KIP        - IP SPRING RATE        =  0.00000E+00
23 CIP        - IP DAMPING RATE       =  0.00000E+00
                                                                MORE...
24 OM         - RPM                   =  3.24000E+02
25 IC         - ROTATION DIRECTION    =            1
26 PSI0       - AZIMUTH OF REF BLADE=    0.00000E+00
27 MHUB       - HUB WEIGHT (LB)       =  0.00000E+00
28 IHUBX      - HUB M.O.I. ABOUT X-   =  0.00000E+00
29 TH0        - ROOT PTCH ANG (DEG)   =  1.50000E+01
30 NONLIN     - NONLIN TERMS          =         NO
31 IU         - UNIFORM BLADE         =         NO
32 M          - (REAL) MASS PER UNIT LENGTH
              5.78340E+00  5.78340E+00  5.26000E+00  5.26000E+00
              8.90000E-01  8.90000E-01  8.20000E-01  8.44600E-01
              7.97000E-01  7.26000E-01  8.75000E-01  1.09800E+00
              1.06300E+00  1.03900E+00  1.26000E+00  1.18600E+00
              1.26600E+00  1.18900E+00  1.16000E+00  1.16000E+00
33 SE         - (REAL) CG OFFSET FROM EA
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
34 SEA        - (REAL) AREA CENTROID OFFSET
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                                MORE...
```

```
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 35 KM1        - (REAL) MASS ROG ABOUT
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 36 KM2        - (REAL) MASS ROG ABOUT
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 37 KA         - (REAL) AREA ROG OF CROSS
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                              MORE...
 38 THP        - (REAL) PRETWIST RATE DEG/IN
              -4.00000E-02 -4.00000E-02 -4.00000E-02 -4.00000E-02
              -4.00000E-02 -4.00000E-02 -4.00000E-02 -4.00000E-02
              -4.00000E-02 -4.00000E-02 -4.00000E-02 -4.00000E-02
              -4.00000E-02 -4.00000E-02 -4.00000E-02 -4.00000E-02
              -4.00000E-02 -4.00000E-02 -4.00000E-02 -4.00000E-02
 39 EIY        - (REAL) CHORDWISE EI*10E-6
               5.00000E+03  5.00000E+03  5.00000E+03  5.00000E+03
               4.24000E+03  4.24000E+03  4.15000E+03  4.29000E+03
               3.82000E+03  3.60000E+03  3.39000E+03  3.25500E+03
               2.91000E+03  2.65000E+03  2.65000E+03  2.65000E+03
               2.65500E+03  2.66000E+03  2.69000E+03  2.69000E+03
 40 EIZ        - (REAL) BEAMWISE EI*10E-6
               1.80000E+02  1.80000E+02  3.00000E+02  3.00000E+02
               8.95000E+01  8.95000E+01  5.80000E+01  5.30000E+01
               4.60000E+01  4.00000E+01  4.00000E+01  4.10000E+01
               4.10000E+01  3.96000E+01  3.95000E+01  4.20000E+01
               4.24000E+01  4.24000E+01  3.80000E+01  3.80000E+01
 41 EA         - (REAL) SECTION EA*10E-6
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                              MORE...
```

```
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 42 JIL      - INTERNAL LOADS       =          YES
 43 NXIL     - NO. OF STATIONS      =             5
 44 INDIL    - STATION INDICES
                     1         2         3         4         5
 45 JIPIL    - INPLANE MOMENTS      =          YES
 46 JOPIL    - OUTPLANE MOMENTS     =          YES
**********************************************************************

RE-ENTER (Y OR N)
N
DATA SET ROTLAT   FOR CRE3 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
                                                              VM READ
```

2.2.4 CCE1 - Control System, Elastic Rods.

2.2.4.1 CCE1 User Notes - During model formulation, CCE1 must follow the rotor with which it is to be coupled. Control rod degrees of freedom are defined with respect to the rotating coordinate system of the rotor, and swashplate degrees of freedom are defined with respect to the fixed coordinate system of the rotor hub. The number of control rods is equal to the number of blades and all control rods have identical characteristics. However, CSF1 can be used to add or subtract stiffness or damping from a rod or rods resulting in nonidentical control rods. Also note that a control rod is equivalent to a pitch bearing spring or damper.

2.2.4.2 CCE1 Sample Input -

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CCE1
DATA SET
CONROD
SAVE FILE(R,U1,...)
U1

CONTROL SYSTEM COMPONENT CCE1 . CONTROL RODS SWASHPLATE

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
ROTOR CONTROL SYSTEM
------
MSP       (REAL)
    SWASH PLATE MASS
    (LB)
ENTER 1 REAL VALUE
?
                                                              MORE...
20
------
ISP       (REAL)
    MOI ABOUT DIAMETER
    (LB-IN SQ)
ENTER 1 REAL VALUE
?
2000
------
CSCOL     (REAL)
    COLLECTIVE DAMPING
    (LB-SEC/IN)
ENTER 1 REAL VALUE
?
100
------
CSCYC     (REAL)
    CYCLIC DAMPING
    (LB-SEC-IN/DEG)
ENTER 1 REAL VALUE
?
10
                                                              MORE...
```

```
-----
KSCOL     (REAL)
    COLLECTIVE STIFFNESS
    (LB/IN)
ENTER 1 REAL VALUE
?
1000
-----
KSCYC     (REAL)
    CYCLIC STIFFNESS
    (LB-IN/DEG)
ENTER 1 REAL VALUE
?
100
-----
LROD      (REAL)
    AXIS-CONTRL ROD DIST
    (IN)
ENTER 1 REAL VALUE
?
10
-----
                                                                   MORE...
CROD      (REAL)
    CONTROL ROD DAMPING
    (LB-SEC/IN)
ENTER 1 REAL VALUE
?
100
-----
KROD      (REAL)
    CONTRL ROD STIFFNESS
    (LB/IN)
ENTER 1 REAL VALUE
?
1000
***********************************************************************
INPUT FOR CONTROL SYSTEM COMPONENT CCE1. CONTROL RODS SWASHPLATE

  1 MSP      - SWASH PLATE MASS     =  2.00000E+01
  2 ISP      - MOI ABOUT DIAMETER   =  2.00000E+03
  3 CSCOL    - COLLECTIVE DAMPING   =  1.00000E+02
  4 CSCYC    - CYCLIC DAMPING       =  1.00000E+01
  5 KSCOL    - COLLECTIVE STIFFNESS=  1.00000E+03
  6 KSCYC    - CYCLIC STIFFNESS     =  1.00000E+02
                                                                   MORE...
```

```
  7 LROD       - AXIS-CONTRL ROD DIST=  1.00000E+01
  8 CROD       - CONTROL ROD DAMPING =  1.00000E+02
  9 KROD       - CONTRL ROD STIFFNESS=  1.00000E+03
****************************************************************************

RE-ENTER (Y OR N)
N
DATA SET CONROD   FOR CCE1 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
                                                                   VM READ
```

2.2.5 CCEØ - Control System, Elastic Rods.

2.2.5.1 CCEØ User Notes - CCEØ is a simplified version of CCE1. The only input is control rod stiffness. During model formulation, CCEØ must follow the rotor system with which it is coupled.

2.2.5.1 CCEØ Sample Input -

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CCE0
DATA SET
CONROD
SAVE FILE(R,U1,...)
U1

CONTROL SYSTEM COMPONENT CCE0 . CONTROL RODS

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
ROTOR CONTROL SYSTEM
-----
KROD      (REAL)
    CONTRL ROD STIFFNESS
    (LB/IN)
ENTER 1 REAL VALUE
?
                                                                  MORE...
1000
*********************************************************************
INPUT FOR CONTROL SYSTEM COMPONENT CCE0. CONTROL RODS

  1 KROD     - CONTRL ROD STIFFNESS=  1.00000E+03
*********************************************************************

RE-ENTER (Y OR N)
N
DATA SET CONROD   FOR CCE0 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
                                                                  VM READ
```

2.2.6 CSF1 - Structure, Finite Element.

2.2.6.1 CSF1 User Notes - CSF1 can be used to input constant coefficients for any set of equations of motion of the form

$$M\ddot{X} + C\dot{X} + KX = F$$

If a CSF1 data set is used alone in a model or if a model contains only CSF1 data sets and if the degrees of freedom are expressed in consistent units, those units can be purely arbitrary. However, when combined with other types of data sets, CSF1 data sets must be defined so that consistency is maintained. Typical mass, damping, stiffness, force, and moment units have been noted with the input prompts shown for CSF1 in the User's Manual, but any set of consistent units can be used.

2.2.6.2 CSF1 Sample Input - Input for the spring-mass-damper system with constant applied force, shown in Figure 8, follows.

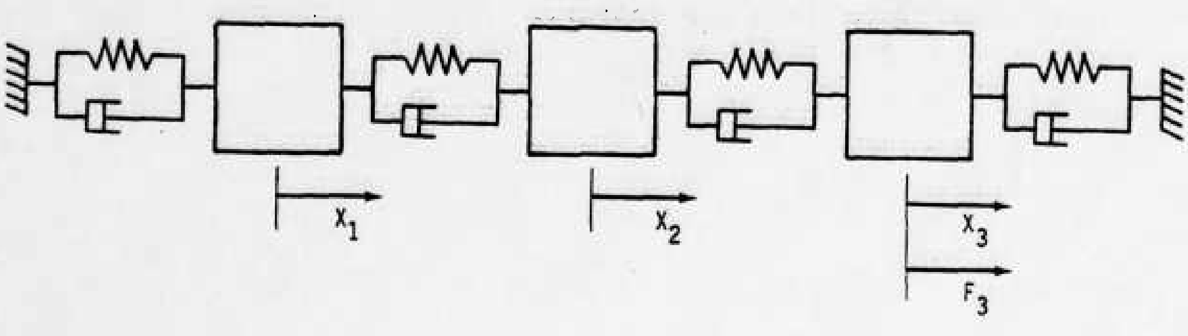

Figure 8. Spring-Mass-Damper System.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CSF1
DATA SET
SMD
SAVE FILE(R,U1,...)
U1


COMPONENT CSF1. FINITE ELEMENT

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
SPRING-MASS-DAMPER SYSTEM
------
NCDF      (INTEGER)
    NUMBER OF DOF
ENTER     1 INTEGER VALUE(S)
3
------
                                                              MORE...
CDFLI     (DOF)
    DOF NAMES
ENTER  3 DOF VALUES  (A4,I4) ONE PER LINE
X   1
X   2
X   3
------
CM        (REAL)
    MASS MATRIX
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
1
INPUT      3 DIAGONAL REAL VALUES
?
1 2 3
------
CC        (REAL)
    DAMPING MATRIX
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
2
PREPARE TO ENTER ROW     1
                                                              MORE...
```

```
ENTER     1 REAL VALUES
?
3
PREPARE TO ENTER ROW     2
ENTER     2 REAL VALUES
?
-2 5
PREPARE TO ENTER ROW     3
ENTER     3 REAL VALUES
?
0 -3 7
-----
CK          (REAL)
    STIFFNESS MATRIX
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
2
PREPARE TO ENTER ROW     1
ENTER     1 REAL VALUES
?
30
PREPARE TO ENTER ROW     2
                                                                  MORE...
ENTER     2 REAL VALUES
?
-20 50
PREPARE TO ENTER ROW     3
ENTER     3 REAL VALUES
?
0 -30 70
-----
CF          (REAL)
    FORCE VECTOR
NULL VECTOR (Y OR N)
N
ENTER  3 REAL VALUE(S)
?
0 0 1
*********************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF       - NUMBER OF DOF          =            3
  2 CDFLI      - (DOF) DOF NAMES
          X   1000  X   2000  X   3000
  3 CM         - (REAL) MASS MATRIX
                                                                  MORE...
```

```
          DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

     1.00000E+00  2.00000E+00  3.00000E+00
 4 CC          - (REAL) DAMPING MATRIX
          SYMMETRIC MATRIX (LOWER TRIANGLE PRINTED)

   ROW    1
         3.00000E+00
   ROW    2
        -2.00000E+00  5.00000E+00
   ROW    3
         0.00000E+00 -3.00000E+00  7.00000E+00
 5 CK          - (REAL) STIFFNESS MATRIX
          SYMMETRIC MATRIX (LOWER TRIANGLE PRINTED)

   ROW    1
         3.00000E+01
   ROW    2
        -2.00000E+01  5.00000E+01
   ROW    3
         0.00000E+00 -3.00000E+01  7.00000E+01
 6 CF          - (REAL) FORCE VECTOR
                                                          MORE...
           0.00000E+00  0.00000E+00  1.00000E+00
**********************************************************************

RE-ENTER (Y OR N)
N
DATA SET SMD      FOR CSF1 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
                                                          VM READ
```

2.2.7 <u>CES1 - Elastic Stop (Nonlinear Spring)</u>.

2.2.7.1 <u>CES1 User Notes</u> - CES1 is generally used in two types of applications: as an elastic stop which allows a degree of freedom to move freely through a specified distance before encountering the resistance of a spring or damper or both, and in an extension of that application, as a component of a nonlinear spring or damper which has specific spring or damping rates for different ranges of displacement.

2.2.7.2 <u>CES1 Sample Input</u> - Two CES1 data sets can be used to model a nonlinear spring for which the Force/Displacement function is shown in figure 9. Up to a displacement of 1 inch (as in the case of CSF1, units may be arbitrary), the spring rate is zero; from 1 to 2 inches, the spring rate is 100 lb/in.; and beyond 2 inches the spring rate is 200 lb/in. Inputs for the data sets follow. Note that the spring rates are additive.

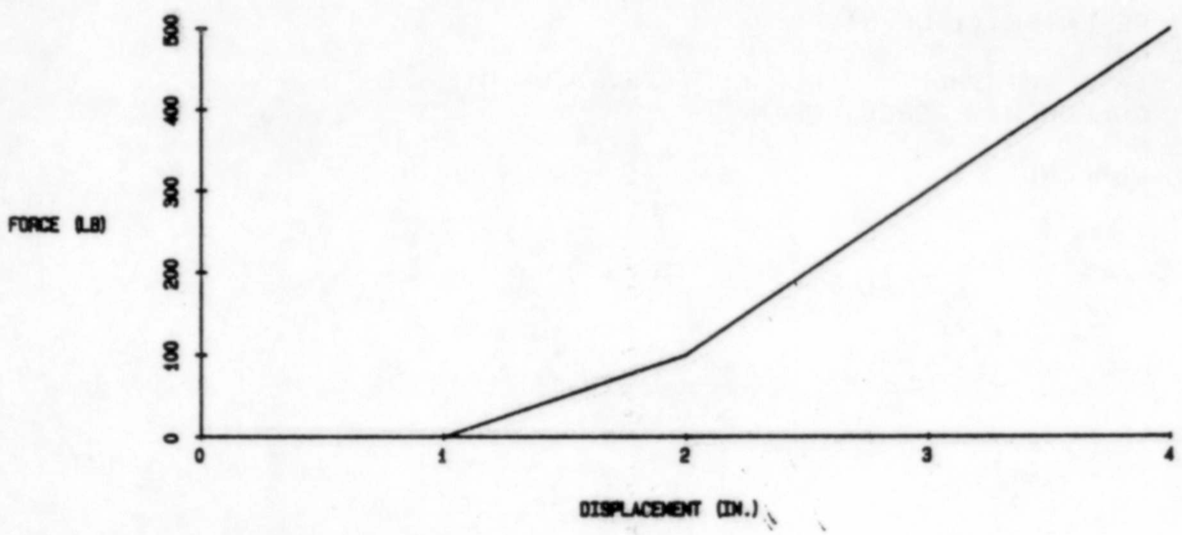

Figure 9. Nonlinear Spring Force/Displacement Function.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CES1
DATA SET
NL1
SAVE FILE(R,U1,...)
U1


COMPONENT CES1. ELASTIC STOP

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
NONLINEAR SPRING
-----
MCDF       (INTEGER)
    # OF DOF--EXCEPT BASE
ENTER     1 INTEGER VALUE(S)
1
-----
                                                    MORE...
CDFLI      (DOF)
    DOF NAMES
ENTER 1 DOF VALUE (A4,I4)
X    1
-----
BASE       (Y OR N)
    EXISTNCE OF BASE DOF
ENTER 1 Y OR N VALUE
N
-----
C1         (REAL)
    UPPER DAMPING COEFF
ENTER 1 REAL VALUE
?
0
-----
C2         (REAL)
    LOWER DAMPING COEFF
ENTER 1 REAL VALUE
?
0
-----
                                                    MORE...
```

```
K1        (REAL)
    UPPER SPRING COEFF
ENTER 1 REAL VALUE
?
100
-----
K2        (REAL)
    LOWER SPRING COEFF
ENTER 1 REAL VALUE
?
100
-----
DELT1     (REAL)
    UPPER GAP SIZE
ENTER 1 REAL VALUE
?
1
-----
DELT2     (REAL)
    LOWER GAP SIZE
ENTER 1 REAL VALUE
?
                                                                MORE...
1
**********************************************************************
INPUT FOR COMPONENT CES1. ELASTIC STOP

  1 MCDF      - # OF DOF-EXCEPT BASE=            1
  2 CDFLI     - DOF NAMES          =      X   1000
  3 BASE      - EXISTNCE OF BASE DOF=          NO
  4 C1        - UPPER DAMPING COEFF =  0.00000E+00
  5 C2        - LOWER DAMPING COEFF =  0.00000E+00
  6 K1        - UPPER SPRING COEFF  =  1.00000E+02
  7 K2        - LOWER SPRING COEFF  =  1.00000E+02
  8 DELT1     - UPPER GAP SIZE      =  1.00000E+00
  9 DELT2     - LOWER GAP SIZE      =  1.00000E+00
**********************************************************************

RE-ENTER (Y OR N)
N
DATA SET NL1       FOR CES1 SAVED ON U1
COMPONENT, FORCE, OR N
CES1
DATA SET
NL2
                                                                MORE...
```

```
SAVE FILE(R,U1,...)
U1


COMPONENT CES1. ELASTIC STOP

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
NONLINEAR SPRING
------
MCDF      (INTEGER)
    # OF DOF-EXCEPT BASE
ENTER     1 INTEGER VALUE(S)
1
------
CDFLI     (DOF)
    DOF NAMES
ENTER 1 DOF VALUE (A4,I4)
X    1
------
BASE      (Y OR N)
    EXISTNCE OF BASE DOF
                                                              MORE...
ENTER 1 Y OR N VALUE
N
------
C1        (REAL)
    UPPER DAMPING COEFF
ENTER 1 REAL VALUE
?
0
------
C2        (REAL)
    LOWER DAMPING COEFF
ENTER 1 REAL VALUE
?
0
------
K1        (REAL)
    UPPER SPRING COEFF
ENTER 1 REAL VALUE
?
100
------
K2        (REAL)
                                                              MORE...
```

```
    LOWER SPRING COEFF
ENTER 1 REAL VALUE
?
100
-----
DELT1    (REAL)
    UPPER GAP SIZE
ENTER 1 REAL VALUE
?
2
-----
DELT2    (REAL)
    LOWER GAP SIZE
ENTER 1 REAL VALUE
?
2
***********************************************************************
INPUT FOR COMPONENT CES1. ELASTIC STOP

  1 MCDF      - # OF DOF-EXCEPT BASE=           1
  2 CDFLI     - DOF NAMES           =       X    1000
  3 BASE      - EXISTNCE OF BASE DOF=          NO
                                                              MORE...
  4 C1        - UPPER DAMPING COEFF =  0.00000E+00
  5 C2        - LOWER DAMPING COEFF =  0.00000E+00
  6 K1        - UPPER SPRING COEFF  =  1.00000E+02
  7 K2        - LOWER SPRING COEFF  =  1.00000E+02
  8 DELT1     - UPPER GAP SIZE      =  2.00000E+00
  9 DELT2     - LOWER GAP SIZE      =  2.00000E+00
***********************************************************************

RE-ENTER (Y OR N)
N
DATA SET NL2      FOR CES1 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
                                                              VM READ
```

2.2.8 CLC1 - Linear Constraints.

2.2.8.1 CLC1 User Notes - CLC1 allows the user to replace an existing degree of freedom of a component with a function of other, arbitrary degrees of freedom. The function must have constant coefficients. This equation, with others, can be formulated in matrix form:

$$\{X_I\} = [T]\{X\}$$

where X_I are the implicit degrees of freedom being replaced by functions of arbitrary degrees of freedom, X. X cannot include degrees of freedom from X_I; a degree of freedom cannot be a function of itself.

2.2.8.2 CLC1 Sample Input - In this example, CLC1 is used to impose an elastic coupling constraint on two identical fuselage representations (refer to paragraph 2.2.1.2, first example). The two fuselages are to be elastically coupled at abutting ends. The constraint is defined by equating the sums of the modal displacements and slopes (angular displacements) of the two fuselages at the point of attachment:

Displacement

ZCG1ØØØ - (360)PTCH1ØØØ + (1.0)QFUS11ØØ =
ZCG2ØØØ + (120)PTCH2ØØØ + (1.0)QFUS21ØØ

Slope

PTCH1ØØØ - .01 QFUS11ØØ =
PTCH2ØØØ - .01 QFUS21ØØ

Substituting the second equation into the first yields

ZCG1ØØØ = ZCG2ØØØ + (480)PTCH2ØØØ - (2.6)QFUS21ØØ + (2.6)QFUS11ØØ

PTCH1ØØØ = PTCH2ØØØ - (.01)QFUS21ØØ + (.01)QFUS11ØØ

which is input into a CLC1 data set as shown. The two degrees of freedom, ZCG1ØØØ and PTCH1ØØØ, will be replaced by the two implicit relations.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CLC1
DATA SET
CBEAM
SAVE FILE(R,U1,...)
U1


COMPONENT CLC1. LINEAR CONSTRAINTS

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
ELASTIC COUPLING
------
NCDF      (INTEGER)
    NUMBER OF DOF
ENTER     1 INTEGER VALUE(S)
4
------
                                                                MORE...
CDFLI     (DOF)
    DOF NAMES
ENTER  4 DOF VALUES  (A4,I4) ONE PER LINE
ZCG 2000
PTCH2000
QFUS2100
QFUS1100
------
NCIDF     (INTEGER)
    # OF CONSTRAINT EQNS
ENTER     1 INTEGER VALUE(S)
2
------
CIDFLI    (DOF)
    IMPLICIT DOF NAMES
ENTER  2 DOF VALUES  (A4,I4) ONE PER LINE
ZCG 1000
PTCH1000
------
COEF      (REAL)
    COEFFICIENT MATRIX
TYPE MATRIX
                                                                MORE...
```

```
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  4 REAL VALUES
?
1 480 -2.6 2.6
PREPARE TO ENTER ROW  2
ENTER  4 REAL VALUES
?
0 1 -.01 .01
***********************************************************************
INPUT FOR COMPONENT CLC1. LINEAR CONSTRAINTS

  1 NCDF      - NUMBER OF DOF         =              4
  2 CDFLI     - (DOF) DOF NAMES
           ZCG 2000  PTCH2000  QFUS2100  QFUS1100
  3 NCIDF     - # OF CONSTRAINT EQNS=                2
  4 CIDFLI    - IMPLICIT DOF NAMES   =      ZCG 1000      PTCH1000
                                                             MORE...
  5 COEF      - (REAL) COEFFICIENT MATRIX
           GENERAL MATRIX

    ROW     1
          1.00000E+00  4.80000E+02 -2.60000E+00  2.60000E+00
    ROW     2
          0.00000E+00  1.00000E+00 -1.00000E-02  1.00000E-02
***********************************************************************

RE-ENTER (Y OR N)
N
DATA SET CBEAM    FOR CLC1 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
                                                             VM READ
```

2.2.9 CFM3 - Fuselage, Modal (3-d).

2.2.9.1 CFM3 User Notes - Mode shapes need only be defined at node points where coupling with other components is to take place. Up to three translational and three rotational implicit degrees of freedom can be specified (NODOF) in local coordinate systems defined separately at each of those points. The user defines the X and Y vectors of the local coordinate systems in terms of the fuselage coordinate system (X and Y vector direction cosines).

2.2.9.2 CFM3 Sample Input - Input is shown for a CFM3 data set with four rigid body modes and eight elastic modes. The rigid body modes are defined at the CG and the elastic modes are defined at four node points. Mode shape input is only shown for one component of modal displacement for the first elastic mode. Four implicit degrees of freedom consistent with the fuselage degrees of freedom are specified at each of the node points. The local X, Y vectors coincide with the fuselage coordinate system vectors.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CFM3
DATA SET
FS1
SAVE FILE(R,U1,...)
U1

STRUCTURAL COMPONENT CFM3 . 3-D MODAL FUSELAGE

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
PACOSS SEGMENT 1
------
RBM       (Y OR N)
    RIGID BODY MODES
ENTER 1 Y OR N VALUE
Y
------
                                                        MORE...
IXCG      (Y OR N)
    LONGITUDINAL
ENTER 1 Y OR N VALUE
N
------
IYCG      (Y OR N)
    LATERAL
ENTER 1 Y OR N VALUE
Y
------
IZCG      (Y OR N)
    VERTICAL
ENTER 1 Y OR N VALUE
Y
------
IROLL     (Y OR N)
    ROLL
ENTER 1 Y OR N VALUE
N
------
IPTCH     (Y OR N)
    PITCH
                                                        MORE...
```

```
ENTER 1 Y OR N VALUE
Y
------
IYAW      (Y OR N)
    YAW
ENTER 1 Y OR N VALUE
Y
------
CG        (REAL)
    XYZ CG LOCATION (IN)
NULL VECTOR (Y OR N)
Y
------
NS        (INTEGER)
    NO. OF NODAL POINTS
ENTER     1 INTEGER VALUE(S)
4
------
XYZNS     (REAL)
    XYZ FOR EACH NODE
    XYZ REF. TO FUSELAGE SYS.
TYPE MATRIX
                                                                 MORE...
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
C
OPTION TO SPECIFY NULL COLUMNS (Y OR N)
N
PREPARE TO ENTER COL  1
ENTER  3 REAL VALUES
?
-120 -20 -20
PREPARE TO ENTER COL  2
ENTER  3 REAL VALUES
?
-120 -20 20
PREPARE TO ENTER COL  3
ENTER  3 REAL VALUES
?
-120 20 20
PREPARE TO ENTER COL  4,
ENTER  3 REAL VALUES
?
-120 20 -20
                                                                 MORE...
```

```
-----
NMODE     (INTEGER)
    NO. OF ELASTIC MODES
ENTER     1 INTEGER VALUE(S)
8
-----
MXCG      (Y OR N)
    MODE X-COMPONENT
ENTER 1 Y OR N VALUE
N
-----
MYCG      (Y OR N)
    MODE Y-COMPONENT
ENTER 1 Y OR N VALUE
Y
-----
MZCG      (Y OR N)
    MODE Z-COMPONENT
ENTER 1 Y OR N VALUE
Y
-----
MROLL     (Y OR N)
                                                              MORE...
    MODE ALFX-COMPONENT
ENTER 1 Y OR N VALUE
N
-----
MPTCH     (Y OR N)
    MODE ALFY-COMPONENT
ENTER 1 Y OR N VALUE
Y
-----
MYAW      (Y OR N)
    MODE ALFZ-COMPONENT
ENTER 1 Y OR N VALUE
Y
-----
YY        (REAL)
    MODES Y-COMPONENT
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
                                                              MORE...
```

```
Y
NULL ROW  1 (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  4 REAL VALUES
?
-27.5611 -10.8154 -10.8265 -27.5335
NULL ROW  2 (Y OR N)
Y
NULL ROW  3 (Y OR N)
Y
NULL ROW  4 (Y OR N)
Y
NULL ROW  5 (Y OR N)
Y
NULL ROW  6 (Y OR N)
Y
NULL ROW  7 (Y OR N)
Y
NULL ROW  8 (Y OR N)
Y
-----
                                                                    MORE...
ZZ         (REAL)
    MODES Z-COMPONENT
TYPE MATRIX
(0=NULL),(3=GENERAL)
0
-----
YYP        (REAL)
    MODES ALFY-COMPONENT
TYPE MATRIX
(0=NULL),(3=GENERAL)
0
-----
ZZP        (REAL)
    MODES ALFZ-COMPONENT
TYPE MATRIX
(0=NULL),(3=GENERAL)
0
-----
NODOF      (Y OR N)
    DOF Y OR N FOR NODES
PREPARE TO ENTER ROW   1
ENTER     4 Y OR N VALUES (35A2)
                                                                    MORE...
```

```
N N N N
PREPARE TO ENTER ROW   2
ENTER     4 Y OR N VALUES (35A2)
Y Y Y Y
PREPARE TO ENTER ROW   3
ENTER     4 Y OR N VALUES (35A2)
Y Y Y Y
PREPARE TO ENTER ROW   4
ENTER     4 Y OR N VALUES (35A2)
N N N N
PREPARE TO ENTER ROW   5
ENTER     4 Y OR N VALUES (35A2)
Y Y Y Y
PREPARE TO ENTER ROW   6
ENTER     4 Y OR N VALUES (35A2)
Y Y Y Y
------
XYZD      (REAL)
    LOCAL X,Y VECTORS
    IN TERMS OF FUSELAGE SYS.
TYPE MATRIX
(0=NULL),(3=GENERAL)
                                                                MORE...
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
Y
NULL ROW  1 (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  4 REAL VALUES
?
1 1 1 1
NULL ROW  2 (Y OR N)
Y
NULL ROW  3 (Y OR N)
Y
NULL ROW  4 (Y OR N)
Y
NULL ROW  5 (Y OR N)
N
PREPARE TO ENTER ROW  5
ENTER  4 REAL VALUES
?
                                                                MORE...
```

```
1 1 1 1
NULL ROW  6 (Y OR N)
Y
-----
MASSL     (REAL)
    FUSELAGE MASS  (LB)
ENTER 1 REAL VALUE
?
153.437
-----
IMYY      (REAL)
    PTCH MOI SLUG-FT(SQ)
ENTER 1 REAL VALUE
?
163.25
-----
IMZZ      (REAL)
    YAW MOI SLUG-FT(SQ)
ENTER 1 REAL VALUE
?
163.25
-----
                                                       MORE...
IMYZ      (REAL)
    YZ PRODUCT OF INERT.
ENTER 1 REAL VALUE
?
0
-----
MMS       (REAL)
    MODAL MASS (SLUGS)
NULL VECTOR (Y OR N)
N
ENTER  8 REAL VALUE(S)
?
80.248 81.122 84.373 85.367
?
.21539 .26977 .26613 .21273
-----
MD        (REAL)
    MODAL DAMPING (PCT)
NULL VECTOR (Y OR N)
Y
-----
FREQ      (REAL)
                                                       MORE...
```

```
    MODAL FREQUENCY (HZ)
NULL VECTOR (Y OR N)
N
ENTER  8 REAL VALUE(S)
?
18.901 18.907 18.909 18.910
?
37.513 37.517 37.518 37.527
*********************************************************************
INPUT FOR STRUCTURAL      COMPONENT CFM3. 3-D MODAL FUSELAGE

  1 RBM       - RIGID BODY MODES    =          YES
  2 IXCG      - LONGITUDINAL        =          NO
  3 IYCG      - LATERAL             =          YES
  4 IZCG      - VERTICAL            =          YES
  5 IROLL     - ROLL                =          NO
  6 IPTCH     - PITCH               =          YES
  7 IYAW      - YAW                 =          YES
  8 CG        - (REAL) XYZ CG LOCATION (IN)
              0.00000E+00  0.00000E+00  0.00000E+00
  9 NS        - NO. OF NODAL POINTS =             4
 10 XYZNS     - (REAL) XYZ FOR EACH NODE
                                                                MORE...
           GENERAL MATRIX

    ROW     1
        -1.20000E+02 -1.20000E+02 -1.20000E+02 -1.20000E+02
    ROW     2
        -2.00000E+01 -2.00000E+01  2.00000E+01  2.00000E+01
    ROW     3
        -2.00000E+01  2.00000E+01  2.00000E+01 -2.00000E+01
 11 NMODE      - NO. OF ELASTIC MODES=             8
 12 MXCG       - MODE X-COMPONENT    =        NO
 13 MYCG       - MODE Y-COMPONENT    =        YES
 14 MZCG       - MODE Z-COMPONENT    =        YES
 15 MROLL      - MODE ALFX-COMPONENT =        NO
 16 MPTCH      - MODE ALFY-COMPONENT =        YES
 17 MYAW       - MODE ALFZ-COMPONENT =        YES
 18 YY         - (REAL) MODES Y-COMPONENT
           GENERAL MATRIX

    ROW     1
        -2.75611E+01 -1.08154E+01 -1.08265E+01 -2.75335E+01
    ROW     2      NULL ROW
    ROW     3      NULL ROW
                                                                MORE...
```

```
    ROW     4       NULL ROW
    ROW     5       NULL ROW
    ROW     6       NULL ROW
    ROW     7       NULL ROW
    ROW     8       NULL ROW
 19 ZZ            - (REAL) MODES Z-COMPONENT
              NULL MATRIX

 20 YYP           - (REAL) MODES ALFY-COMPONENT
              NULL MATRIX

 21 ZZP           - (REAL) MODES ALFZ-COMPONENT
              NULL MATRIX

 22 NODOF         - DOF Y OR N FOR NODES
ROW       1
              NO   NO   NO   NO
ROW       2
              YES YES YES YES
ROW       3
              YES YES YES YES
ROW       4
                                                              MORE...
              NO   NO   NO   NO
ROW       5
              YES YES YES YES
ROW       6
              YES YES YES YES
 23 XYZD          - (REAL) LOCAL X,Y VECTORS
              GENERAL MATRIX

    ROW     1
             1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
    ROW     2       NULL ROW
    ROW     3       NULL ROW
    ROW     4       NULL ROW
    ROW     5
             1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
    ROW     6       NULL ROW
 24 MASSL         - FUSELAGE MASS  (LB) =   1.53437E+02
 25 IMYY          - PTCH MOI SLUG-FT(SQ)=   1.63250E+02
 26 IMZZ          - YAW MOI SLUG-FT(SQ) =   1.63250E+02
 27 IMYZ          - YZ PRODUCT OF INERT.=   0.00000E+00
 28 MMS           - (REAL) MODAL MASS (SLUGS)
                8.02480E+01  8.11220E+01  8.43730E+01  8.53670E+01
                                                              MORE...
```

```
                2.15390E-01  2.69770E-01  2.66130E-01  2.12730E-01
 29 MD          - (REAL) MODAL DAMPING (PCT)
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 30 FREQ        - (REAL) MODAL FREQUENCY (HZ)
                1.89010E+01  1.89070E+01  1.89090E+01  1.89100E+01
                3.75130E+01  3.75170E+01  3.75180E+01  3.75270E+01
************************************************************************

RE-ENTER (Y OR N)
N
DATA SET PS1      FOR CFM3 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
                                                              VM READ
```

2.2.10 CRD3 - Rotor, Damaged (Nonidentical) Blades.

2.2.10.1 CRD3 User Notes - Careful attention must be paid to the blade property input. The user is asked to input two types of blade properties, incremental and nonincremental. An incremental value is the change in a nominal value input for CRE3, and a nonincremental value replaces a value input for CRE3. Illustrations of these two types of input occur in the following example and are discussed.

Note that as with CRE3, "switches" can be set which allow time history blade moments to be calculated (SII3).

2.2.10.2 CRD3 Sample Input - Input is shown for a CRD3 data set which removes 1 lb from the blade tips of the rotor modeled in Section 6 of the User's Manual (B2Z1T2/CRE3). The user must select the same type and number of blade degrees of freedom as selected for the CRE3 data set.

The change in mass per unit length and the associated CG offset from the elastic axis and mass radius of gyration about the beamwise axis have been input for the affected blade stations. The inputs for SE and KM2 for the affected stations are nonincremental values. Thus, to retain the values input for the CRE3 data set, changing only mass, the values for SE and KM2 from the CRE3 data set have been input for the affected stations. To retain the same blade pretwist rates, the values from the CRE3 data set must also be input, but for all stations, in order to retain the same blade geometry. Nonincremental parameters previously set to zero have been reset to zero. Incremental parameters for which there are no changes have also been set to zero.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CRD3
DATA SET
B2Z1T2
SAVE FILE(R,U1,...)
U1

DAMAGED ROTOR COMPONENT CRD3 . ROTOR DAMAGED BLADES

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
1 LB REMOVED FROM BLADE TIPS
-----
JV      (Y OR N)
   INPLANE DOF
ENTER 1 Y OR N VALUE
Y
-----
                                                    MORE...
JW      (Y OR N)
   OUTPLANE DOF
ENTER 1 Y OR N VALUE
Y
-----
JP      (Y OR N)
   TORSION DOF
ENTER 1 Y OR N VALUE
Y
-----
NV      (INTEGER)
   NO. OF INPLANE MODES
ENTER    1 INTEGER VALUE(S)
1
-----
NW      (INTEGER)
   NO. OF OUTPLNE MODES
ENTER    1 INTEGER VALUE(S)
2
-----
NP      (INTEGER)
   NO. OF TORSION MODES

                                                    MURE...
```

```
ENTER     1 INTEGER VALUE(S)
2
-----
NDB       (INTEGER)
    NO. OF DAMAGED
    BLADES
ENTER     1 INTEGER VALUE(S)
2
-----
IDB       (INTEGER)
    BLADE NOS. OF
    DAMAGED BLADES
ENTER     2 INTEGER VALUE(S)
1 2
-----
NX        (INTEGER)
    NO. OF BLADE STAS

ENTER     1 INTEGER VALUE(S)
20
-----
JXD       (Y OR N)
                                                             MORE...

    NEW STATIONS
ENTER 1 Y OR N VALUE
N
-----
ITYP      (INTEGER)
    MODE INPUT 0,1, OR 2
    0 = USE OLD MODE SHAPES, 1 = INPUT NEW MODE SHAPES, 2 = GENERATE
    NEW MODE SHAPES
ENTER     1 INTEGER VALUE(S)
0
-----
CIPP      (REAL)
    IP MODAL DAMPING
    INCREMENT   (LBF-SEC/IN)
ENTER  1 REAL VALUE(S)
?
0
-----
COPP      (REAL)
    OP MODAL DAMPING
    INCREMENT   (LBF-SEC/IN)
NULL VECTOR (Y OR N)
                                                             MORE...
```

```
Y
-----
CTORR     (REAL)
    TORSION MODAL
    DAMPING INCREMENT    (IN-LBF-SEC/DEG)
NULL VECTOR (Y OR N)
Y
-----
KIP       (REAL)
    IP SPRING RATE
    INCREMENT    (IN-LBF/DEG)
ENTER 1 REAL VALUE
?
0
-----
CIP       (REAL)
    IP DAMPING RATE
    INCREMENT    (IN-LBF-SEC/DEG)
ENTER 1 REAL VALUE
?
0
-----
                                                          MORE...
KOP       (REAL)
    OP SPRING RATE
    INCREMENT    (IN-LBF/DEG)
ENTER 1 REAL VALUE
?
0
-----
COP       (REAL)
    OP DAMPING RATE
    INCREMENT    (IN-LBF-SEC/DEG)
ENTER 1 REAL VALUE
?
0
-----
KTOR      (REAL)
    TORSION SPRING RATE
    INCREMENT    (IN-LBF/DEG)
ENTER 1 REAL VALUE
?
0
-----
CTOR      (REAL)
                                                          MORE...
```

```
     TORSION DAMPING RATE
     INCREMENT    (IN-LBF-SEC/DEG)
ENTER 1 REAL VALUE
?
0
-----
IU         (Y OR N)
     UNIFORM BLADE
ENTER 1 Y OR N VALUE
N
-----
M          (REAL)
     MASS PER UNIT LENGTH
     INCREMENT    (LB/IN)
NULL VECTOR (Y OR N)
N
ENTER 20 REAL VALUE(S)
?
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -.16 -.16
-----
SE         (REAL)
     CG OFFSET FROM EA
                                                                  MORE...
     (IN)
NULL VECTOR (Y OR N)
N
ENTER 20 REAL VALUE(S)
?
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -1.97 -1.97
-----
SEA        (REAL)
     AREA CENTROID OFFSET
     FROM EA (+ FWD EA) (IN)
NULL VECTOR (Y OR N)
Y
-----
KM1        (REAL)
     MASS ROG ABOUT
     LOCAL CHORDWISE AXIS IN BEAMWISE DIRECTION (IN)
NULL VECTOR (Y OR N)
Y
-----
KM2        (REAL)
     MASS ROG ABOUT
     LOCAL BEAMWISE AXIS IN CHORDWISE DIRECTION (IN)
                                                                  MORE...
```

```
NULL VECTOR (Y OR N)
N
ENTER 20 REAL VALUE(S)
?
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 7.11 7.11
-----
KA        (REAL)
    AREA ROG OF CROSS
    SECTION (IN)
NULL VECTOR (Y OR N)
Y
-----
THP       (REAL)
    PRETWIST RATE DEG/IN
NULL VECTOR (Y OR N)
N
ENTER 20 REAL VALUE(S)
?
-.0378753 -.0378753 -.0378753 -.0378753 -.0378753 -.0378753 -.0378753
?
-.0378753 -.0378753 -.0378753 -.0378753 -.0378753 -.0378753 -.0378753
?
                                                              MORE...
-.0378753 -.0378753 -.0378753 -.0378753 -.0378753 -.0378753
-----
EIY       (REAL)
    CHORDWISE EI*10E-6
    INCREMENT   (LBF*IN**2)
NULL VECTOR (Y OR N)
Y
-----
EIZ       (REAL)
    BEAMWISE EI*10E-6
    INCREMENT   (LBF*IN**2)
NULL VECTOR (Y OR N)
Y
-----
EA        (REAL)
    SECTION EA*10E-6
    INCREMENT   (LBF)
NULL VECTOR (Y OR N)
Y
-----
GJ        (REAL)
    SECTION GJ*10E-6
                                                              MORE...
```

```
    INCREMENT    (LBF*IN**2)
NULL VECTOR (Y OR N)
Y
-----
EB1         (REAL)
    CROSS SEC INTEGRAL
    INCREMENT    (IN**6) (SEE MANUAL)
NULL VECTOR (Y OR N)
Y
-----
EB2         (REAL)
    CROSS SEC INTEGRAL
    INCREMENT    (IN**5) (SEE MANUAL)
NULL VECTOR (Y OR N)
Y
-----
EC1         (REAL)
    CROSS SEC INTEGRAL
    INCREMENT    (IN**6) (SEE MANUAL)
NULL VECTOR (Y OR N)
Y
-----
                                                                  MORE...
EC1STA      (REAL)
    CROSS SEC INTEGRAL
    INCREMENT    (IN**5) (SEE MANUAL)
NULL VECTOR (Y OR N)
Y
-----
JIL         (Y OR N)
    INTERNAL LOADS
ENTER 1 Y OR N VALUE
N
**************************************************************************
INPUT FOR DAMAGED ROTOR  COMPONENT CRD3. ROTOR DAMAGED BLADES

  1 JV        - INPLANE DOF           =          YES
  2 JW        - OUTPLANE DOF          =          YES
  3 JP        - TORSION DOF           =          YES
  4 NV        - NO. OF INPLANE MODES=              1
  5 NW        - NO. OF OUTPLNE MODES=              2
  6 NP        - NO. OF TORSION MODES=              2
  7 NDB       - NO. OF DAMAGED        =            2
  8 IDB       - BLADE NOS. OF         =            1            2
  9 NX        - NO. OF BLADE STAS     =           20
                                                                  MORE...
```

```
10 JXD        - NEW STATIONS          =          NO
11 ITYP       - MODE INPUT 0,1, OR 2=             0
12 CIPF       - IP MODAL DAMPING      =  0.00000E+00
13 COPP       - OP MODAL DAMPING      =  0.00000E+00  0.00000E+00
14 CTORR      - TORSION MODAL         =  0.00000E+00  0.00000E+00
15 KIP        - IP SPRING RATE        =  0.00000E+00
16 CIP        - IP DAMPING RATE       =  0.00000E+00
17 KOP        - OP SPRING RATE        =  0.00000E+00
18 COP        - OP DAMPING RATE       =  0.00000E+00
19 KTOR       - TORSION SPRING RATE   =  0.00000E+00
20 CTOR       - TORSION DAMPING RATE=    0.00000E+00
21 IU         - UNIFORM BLADE         =          NO
22 M          - (REAL) MASS PER UNIT LENGTH
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00 -1.60000E-01 -1.60000E-01
23 SE         - (REAL) CG OFFSET FROM EA
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                          MORE...
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00 -1.97000E+00 -1.97000E+00
24 SEA        - (REAL) AREA CENTROID OFFSET
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
25 KM1        - (REAL) MASS ROG ABOUT
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
26 KM2        - (REAL) MASS ROG ABOUT
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  7.11000E+00  7.11000E+00
27 KA         - (REAL) AREA ROG OF CROSS
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                          MORE...
```

```
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 28 THP          - (REAL) PRETWIST RATE DEG/IN
                -3.78753E-02 -3.78753E-02 -3.78753E-02 -3.78753E-02
                -3.78753E-02 -3.78753E-02 -3.78753E-02 -3.78753E-02
                -3.78753E-02 -3.78753E-02 -3.78753E-02 -3.78753E-02
                -3.78753E-02 -3.78753E-02 -3.78753E-02 -3.78753E-02
                -3.78753E-02 -3.78753E-02 -3.78753E-02 -3.78753E-02
 29 EIY          - (REAL) CHORDWISE EI*10E-6
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 30 EIZ          - (REAL) BEAMWISE EI*10E-6
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                              MORE...
 31 EA           - (REAL) SECTION EA*10E-6
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 32 GJ           - (REAL) SECTION GJ*10E-6
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 33 EB1          - (REAL) CROSS SEC INTEGRAL
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 34 EB2          - (REAL) CROSS SEC INTEGRAL
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                              MORE...
```

```
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 35 EC1          - (REAL) CROSS SEC INTEGRAL
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 36 EC1STA       - (REAL) CROSS SEC INTEGRAL
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 37 JIL          - INTERNAL LOADS        =         NO
*****************************************************************************

RE-ENTER (Y OR N)
N
DATA SET B2Z1T2   FOR CRD3 SAVED ON U1
COMPONENT, FORCE, OR N
N
                                                                  MORE...
COMMAND
                                                                  VM READ
```

2.2.11 CLC2 - Linear Constraints.

2.2.11.1 CLC2 User Notes - CLC2 solves for the implicit degrees of freedom selected by the user for a set of constraint equations. However, improper selection of implicit degrees of freedom will result in partitioning the input coefficients into a singular matrix during the definition phase of a RUN, preventing solution of the constraint equations. The RUN will be terminated and the user will be asked to edit the CLC2 data set and specify new implicit degrees of freedom. Also, in some cases, implicit degree of freedom selections, though not improper, will result in an ill-conditioned matrix and erroneous implicit coefficients. When a new CLC2 data set (or a new model) is implemented, the user should carefully examine the model details, including the implicit coefficient table, and the constant coupled system matrices to determine if the model has been formulated correctly.

2.2.11.2 CLC2 Sample Input - Input is shown for a CLC2 data set which imposes the same constraint derived for the CLC1 example. The displacement and slope relations have been input directly and the implicit degrees of freedom selected as shown.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CLC2
DATA SET
CBEAM
SAVE FILE(R,U1,...)
U1

COMPONENT CLC2. LINEAR CONSTRAINTS

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
ELASTIC COUPLING
-----
NCDF      (INTEGER)
    NUMBER OF DOF
ENTER      1 INTEGER VALUE(S)
6
-----
                                                          MORE...
CDFLI     (DOF)
    DOF NAMES
ENTER   6 DOF VALUES   (A4,I4) ONE PER LINE
ZCG 1000
ZCG 2000
PTCH1000
PTCH2000
QFUS1100
QFUS2100
-----
NCIDF     (INTEGER)
    NO OF CONSTRAINT EQS
ENTER      1 INTEGER VALUE(S)
2
-----
COEF      (REAL)
    COEFFICIENT MATRIX
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
                                                          MORE...
```

```
OPTION TO SPECIFY NULL ROWS (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  6 REAL VALUES
?
1 -1 -360 -120 1 -1
PREPARE TO ENTER ROW  2
ENTER  6 REAL VALUES
?
0 0 1 -1 -.01 .01
-----
NIDOF     (INTEGER)
   NO OF IMPLICIT DOF
ENTER     1 INTEGER VALUE(S)
2
-----
INDEX     (INTEGER)
   IMPLICIT DOF INDICES
ENTER     2 INTEGER VALUE(S)
1 3
**********************************************************************
INPUT FOR COMPONENT CLC2. LINEAR CONSTRAINTS
                                                         MORE...

  1 NCDF      - NUMBER OF DOF        =           6
  2 CDFLI     - (DOF) DOF NAMES
           ZCG 1000  ZCG 2000  PTCH1000  PTCH2000  QFUS1100
           QFUS2100
  3 NCIDF     - NO OF CONSTRAINT EQS=            2
  4 COEF      - (REAL) COEFFICIENT MATRIX
           GENERAL MATRIX

    ROW     1
          1.00000E+00 -1.00000E+00 -3.60000E+02 -1.20000E+02
          1.00000E+00 -1.00000E+00
    ROW     2
          0.00000E+00  0.00000E+00  1.00000E+00 -1.00000E+00
         -1.00000E-02  1.00000E-02
  5 NIDOF     - NO OF IMPLICIT DOF   =           2
  6 INDEX     - IMPLICIT DOF INDICES=            1          3
**********************************************************************

RE-ENTER (Y OR N)
N
DATA SET CBEAM    FOR CLC2 SAVED ON U1
                                                         MORE...
COMPONENT, FORCE, OR N
N
COMMAND
```

2.2.12 CLCØ - Linear Constraints.

2.2.12.1 CLCØ User Notes - The user selects the system or component degrees of freedom to be eliminated from a model and one degree of freedom which is not. The eliminated (implicit) degrees of freedom are automatically set equal to zero times the retained (explicit) degree of freedom.

2.2.12.2 CLCØ Sample Input - Input is shown for a CLCØ data set which, when combined with the previously discussed CLC2 and CFM2 data sets, results in a single elastic fuselage free to pivot about a single fixed point.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CLC0
DATA SET
GROUND
SAVE FILE(R,U1,...)
U1

COMPONENT CLC0. ELIMINATE DOF

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
ELIMINATE RIGID BODY DOF
------
NCIDF     (INTEGER)
    # OF ELIMINATED DOF
ENTER     1 INTEGER VALUE(S)
1
------
                                                                  MORE...
CIDFLI    (DOF)
    ELIMINATED DOF NAMES
ENTER 1 DOF VALUE (A4,I4)
ZCG 2000
------
CDFLI     (DOF)
    1 EXPLICIT DOF NAME
ENTER 1 DOF VALUE (A4,I4)
PTCH2000
*********************************************************************
INPUT FOR COMPONENT CLC0. ELIMINATE DOF

  1 NCIDF    - # OF ELIMINATED DOF =            1
  2 CIDFLI   - ELIMINATED DOF NAMES=     ZCG 2000
  3 CDFLI    - 1 EXPLICIT DOF NAME =     PTCH2000
*********************************************************************

RE-ENTER (Y OR N)
N
DATA SET GROUND   FOR CLC0 SAVED ON U1
COMPONENT, FORCE, OR N
N
                                                                  MORE...
COMMAND
                                                                  VM READ
```

2.2.13 CGF2 - General Force.

2.2.13.1 CGF2 User Notes - CGF2 is used to apply periodic forces to component and system degrees of freedom during a time integration type solution. The component mass, damping, and stiffness matrices are automatically set to zero, and a time-varying force vector can be defined with a combination of polynomial, Fourier series, and Tabular functions. The functions can only be applied to degrees of freedom included as component degrees of freedom of the data set. Rigid body and elastic (modal) degrees of freedom are allowed. The force amplitude (units: lb, in.-lb, etc.) is determined by the degree of freedom to which it is applied.

Start and end times are input for each force application. The application is repeated with the end time becoming the start time for each successive application, resulting in a periodic function. The periodicity can be eliminated (as when only a single application is desired) by specifying zero force over the remaining time period of interest.

2.2.13.2 CGF2 Sample Input - Input is shown for a CGF2 data set in which two polynomial functions and two tabular functions are applied to four degrees of freedom. The same polynomial function is applied to two of the degrees of freedom, and the same tabular function is applied to the other two. The two functions are shown in Figure 10.

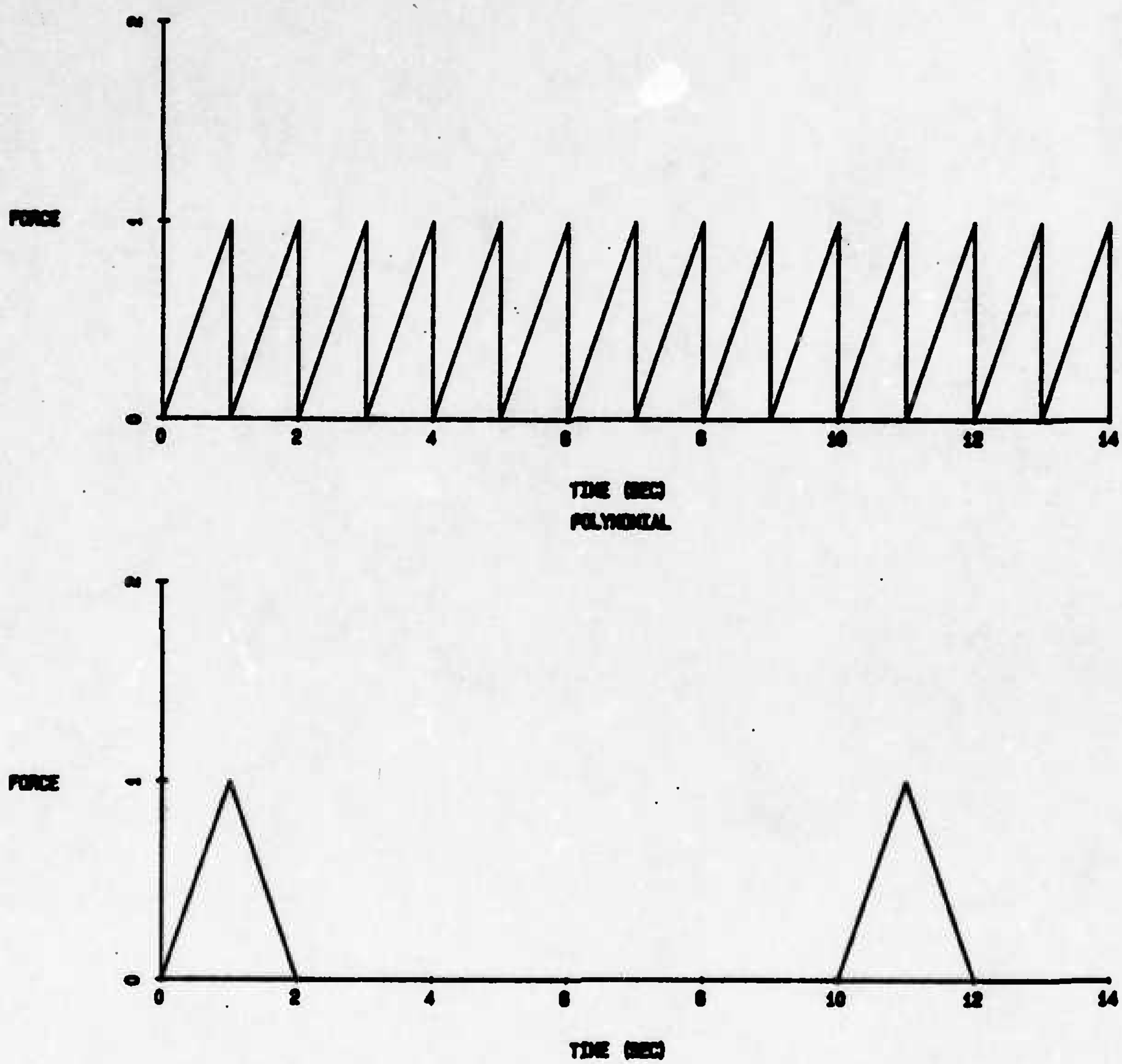

Figure 10. Example Forcing Functions.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CGF2
DATA SET
FORCE
SAVE FILE(R,U1,...)
U1


COMPONENT CGF2. GENERAL FORCE

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
APPLIED FORCE
-----
NODF      (INTEGER)
    NUMBER OF DOF
ENTER     1 INTEGER VALUE(S)
4
-----
                                                                MORE...
NAMEDOF   (DOF)
    DOF NAMES
ENTER  4 DOF VALUES  (A4,I4) ONE PER LINE
X    1
X    2
Y    1
Y    2
-----
IA        (Y OR N)
    TYPE A FORCE
    (POLYNOMIAL)
ENTER 1 Y OR N VALUE
Y
-----
IB        (Y OR N)
    TYPE B FORCE
    (FOURIER SERIES)
ENTER 1 Y OR N VALUE
N
-----
IC        (Y OR N)
    TYPE C FORCE
                                                                MORE...
```

```
    (TABULAR)
ENTER 1 Y OR N VALUE
Y
-----
NA        (INTEGER)
    NO. OF TYPE A
    APPLICATIONS
ENTER     1 INTEGER VALUE(S)
2
-----
NAMENA   (DOF)
    DOF NAME FOR EACH
    TYPE A APPLICATION
ENTER  2 DOF VALUES  (A4,I4) ONE PER LINE
X    1
X    2
-----
COEFNA   (REAL)
    COEFFS FOR EACH
    TYPE A POLYNOMIAL UP TO  4TH POWER
TYPE MATRIX
(0=NULL),(3=GENERAL)
                                                          MORE...
3
INPUT BY ROWS OR COLUMNS (R OR C)
C
OPTION TO SPECIFY NULL COLUMNS (Y OR N)
N
PREPARE TO ENTER COL  1
ENTER  5 REAL VALUES
?
0 1 0 0 0
PREPARE TO ENTER COL  2
ENTER  5 REAL VALUES
?
0 1 0 0 0
-----
T1NA     (REAL)
    START TIME FOR EACH
    TYPE A APPLICATION
NULL VECTOR (Y OR N)
Y
-----
T2NA     (REAL)
    END TIME FOR EACH
                                                          MORE...
```

```
    TYPE A APPLICATION
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
1 1
-----
NC        (INTEGER)
    NO. OF TYPE C
    APPLICATIONS
ENTER    1 INTEGER VALUE(S)
2
-----
NAMENC    (DOF)
    DOF NAME FOR EACH
    TYPE C APPLICATION
ENTER  2 DOF VALUES  (A4,I4) ONE PER LINE
Y   1
Y   2
-----
NSNC1     (INTEGER)
    NO. OF TIME POINTS
                                                          MORE...
    1ST TYPE C APPLICATION
ENTER    1 INTEGER VALUE(S)
4
-----
COEFNC1  (REAL)
    TIMES AND FORCES
    FOR 1ST TYPE C APPLICATION
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
Y
NULL ROW  1 (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  2 REAL VALUES
?
0 0
NULL ROW  2 (Y OR N)
N
                                                          MORE...
```

```
PREPARE TO ENTER ROW  2
ENTER  2 REAL VALUES
?
1 1
NULL ROW  3 (Y OR N)
N
PREPARE TO ENTER ROW  3
ENTER  2 REAL VALUES
?
2 0
NULL ROW  4 (Y OR N)
N
PREPARE TO ENTER ROW  4
ENTER  2 REAL VALUES
?
10 0
-----
NSNC2    (INTEGER)
    NO. OF TIME POINTS
    2ND TYPE C APPLICATION
ENTER    1 INTEGER VALUE(S)
4
```

MORE...

```
-----
COEFNC2  (REAL)
    TIMES AND FORCES
    FOR 2ND TYPE C APPLICATION
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  2 REAL VALUES
?
0 0
PREPARE TO ENTER ROW  2
ENTER  2 REAL VALUES
?
1 1
PREPARE TO ENTER ROW  3
ENTER  2 REAL VALUES
?
```

MORE...

```
2 0
PREPARE TO ENTER ROW  4
ENTER  2 REAL VALUES
?
10 0
**********************************************************************
INPUT FOR COMPONENT CGF2. GENERAL FORCE

  1 NODF      - NUMBER OF DOF        =            4
  2 NAMEDOF   - (DOF) DOF NAMES
           X   1000  X   2000  Y   1000  Y   2000
  3 IA        - TYPE A FORCE         =          YES
  4 IB        - TYPE B FORCE         =          NO
  5 IC        - TYPE C FORCE         =          YES
  6 NA        - NO. OF TYPE A        =            2
  7 NAMENA    - DOF NAME FOR EACH    =      X   1000      X   2000
  8 COEFNA    - (REAL) COEFFS FOR EACH
           GENERAL MATRIX

    ROW     1      NULL ROW
    ROW     2
          1.00000E+00  1.00000E+00
                                                            MORE...
    ROW     3      NULL ROW
    ROW     4      NULL ROW
    ROW     5      NULL ROW
  9 T1NA      - START TIME FOR EACH =  0.00000E+00  0.00000E+00
 10 T2NA      - END TIME FOR EACH    =  1.00000E+00  1.00000E+00
 11 NC        - NO. OF TYPE C        =            2
 12 NAMENC    - DOF NAME FOR EACH    =      Y   1000      Y   2000
 13 NSNC1     - NO. OF TIME POINTS   =            4
 14 COEFNC1   - (REAL) TIMES AND FORCES
           GENERAL MATRIX

    ROW     1      NULL ROW
    ROW     2
          1.00000E+00  1.00000E+00
    ROW     3
          2.00000E+00  0.00000E+00
    ROW     4
          1.00000E+01  0.00000E+00
 15 NSNC2     - NO. OF TIME POINTS   =            4
 16 COEFNC2   - (REAL) TIMES AND FORCES
           GENERAL MATRIX

                                                            MORE...
```

```
   ROW     1       NULL ROW
   ROW     2
         1.00000E+00  1.00000E+00
   ROW     3
         2.00000E+00  0.00000E+00
   ROW     4
         1.00000E+01  0.00000E+00
******************************************************************************

RE-ENTER (Y OR N)
N
DATA SET FORCE    FOR CGF2 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
```

2.2.14 CLG2 - Landing Gear.

2.2.14.1 CLG2 User Notes - The rigid body, strut, and tire degrees of freedom are included automatically; however, degrees of freedom which are not required can be eliminated. When eliminating degrees of freedom, if a given implicit degree of freedom, a tire degree of freedom for instance, is expressed in terms of some number of explicit degrees of freedom (strut, rigid body) and all but one or all of those explicit degrees of freedom are eliminated using CLC, the implicit degree of freedom will become a function of the next set of explicit degrees of freedom shown in the implicit coefficients table (RUN - details). To avoid this problem: (1) if all but one explicit degree of freedom are eliminated, in the model ds/CLC- must precede the data sets (ds/CLG2) in which the explicit degrees of freedom occur; and (2) if all explicit degrees of freedom are eliminated, the ds/CLC- which eliminates the explicit degrees of freedom must be followed by a ds/CLC- which eliminates the implicit degree of freedom and both must precede the data sets in which the explicit degrees of freedom occur.

2.2.14.2 CLG2 Sample Input - Input is shown for a data set which represents the starboard main landing gear of the ACAP helicopter. The gear strut is canted at an angle of 16 degrees in a plane perpendicular to the longitudinal axis of the fuselage; therefore, the strut Z-translation vector has components in the fuselage Y and Z directions, and the strut X-translation vector is parallel to the fuselage X-axis.

The rigid body degrees of freedom have been named as fuselage implicit degrees of freedom (CFM3) to take advantage of the automatic coupling feature. Note that the local coordinate system defined for the implicit degrees of freedom in the CFM3 data set must be consistent with the strut direction cosines.

Finally, the scrubbing coefficients are the coefficients of friction between the ground and the tire for the specified directions. If the brakes-on condition is elected, the brake friction must be accounted for in the longitudinal coefficient.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CLG2
DATA SET
ACAPSTAR
SAVE FILE(R,U1,...)
U1


STRUCTURAL COMPONENT CLG2 . LANDING GEAR

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
STARBOARD MAIN GEAR
------
NAMEZS    (DOF)
     STRUT Z-TRANSLATION
     DOF
ENTER 1 DOF VALUE (A4,I4)
TRAZ1030
                                                                   MORE...
------
NAMEXS    (DOF)
     STRUT X-TRANSLATION
     DOF
ENTER 1 DOF VALUE (A4,I4)
TRAX1030
------
NAMEYS    (DOF)
     STRUT Y-TRANSLATION
     DOF
ENTER 1 DOF VALUE (A4,I4)
TRAY1030
------
NAMEAX    (DOF)
     STRUT X-ROTATION
     DOF
ENTER 1 DOF VALUE (A4,I4)
ROTX1030
------
NAMEAY    (DOF)
     STRUT Y-ROTATION
     DOF
                                                                   MORE...
```

```
ENTER 1 DOF VALUE (A4,I4)
ROTY1030
-----
NAMEDL    (DOF)
    STRUT ELONGATION
    DOF
ENTER 1 DOF VALUE (A4,I4)
LSTR1030
-----
M1        (REAL)
    TIRE MASS
ENTER 1 REAL VALUE
?
.25
-----
M2        (REAL)
    STRUT MASS
ENTER 1 REAL VALUE
?
.1
-----
L0        (REAL)
                                                          MORE...
    UNDEFORMED LENGTH
    OF STRUT
ENTER 1 REAL VALUE
?
64.89
-----
ZCOS      (REAL)
    STRUT Z-TRAN DIR COS
    WRT FUSELAGE COORDS
NULL VECTOR (Y OR N)
N
ENTER  3 REAL VALUE(S)
?
0 .2743 . 616
-----
XCOS      (REAL)
    STRUT X-TRAN DIR COS
    WRT FUSELAGE COORDS
NULL VECTOR (Y OR N)
N
ENTER  3 REAL VALUE(S)
?
                                                          MORE...
```

```
1 0 0
-----
NKL      (INTEGER)
    NO. OF DEF POINTS
    STRUT ELONGATION SPRING
ENTER    1 INTEGER VALUE(S)
2
-----
COEFKLSL (REAL)
    STRUT DISPLACEMENT
ENTER  2 REAL VALUE(S)
?
-10 10
-----
COEFKLSR (REAL)
    STRUT SPRING RATE
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
720 720
-----
                                                                MORE...
NCL      (INTEGER)
    NO. OF DEF POINTS
    STRUT ELONGATION DAMPER
ENTER    1 INTEGER VALUE(S)
2
-----
COEFCLV  (REAL)
    STRUT VELOCITY
ENTER  2 REAL VALUE(S)
?
-100 100
-----
COEFCLDR (REAL)
    STRUT DAMPING RATE
NULL VECTOR (Y OR N)
Y
-----
NKX      (INTEGER)
    NO. OF DEF POINTS
    TIRE LONGITUDINAL SPRING
ENTER    1 INTEGER VALUE(S)
2
                                                                MORE...
```

```
-----
COEFKXLD (REAL)
    TIRE LONG DISPLACEMT

ENTER  2 REAL VALUE(S)
?
-10 10
-----
COEFKXSR (REAL)
    TIRE SPRING RATE
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
1503 1503
-----
NCX      (INTEGER)
    NO. OF DEF POINTS
    TIRE LONGITUDINAL DAMPER
ENTER    1 INTEGER VALUE(S)
2
-----
                                                                  MORE...
COEFCXV  (REAL)
    TIRE LONG VELOCITY
ENTER  2 REAL VALUE(S)
?
-100 100
-----
COEFCXDR (REAL)
    TIRE DAMPING RATE
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
15 15
-----
NKY      (INTEGER)
    NO. OF DEF POINTS
    TIRE LATERAL SPRING
ENTER    1 INTEGER VALUE(S)
2
-----
COEFKYLD (REAL)
    TIRE LAT DISPLACEMT
                                                                  MORE...
```

```
ENTER  2 REAL VALUE(S)
?
-10 10
-----
COEFKYSR (REAL)
    TIRE SPRING RATE
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
1391 1391
-----
NCY       (INTEGER)
    NO. OF DEF POINTS
    TIRE LATERAL DAMPER
ENTER    1 INTEGER VALUE(S)
2
-----
COEFCYV  (REAL)
    TIRE LAT VELOCITY
ENTER  2 REAL VALUE(S)
?
                                                            MORE...
-100 100
-----
COEFCYDR (REAL)
    TIRE DAMPING RATE
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
15 15
-----
NKZ       (INTEGER)
    NO. OF DEF POINTS
    TIRE VERTICAL SPRING
ENTER    1 INTEGER VALUE(S)
2
-----
COEFKZVD (REAL)
    TIRE VERT DISPLACEMT

ENTER  2 REAL VALUE(S)
?
-10 10
                                                            MORE...
```

```
-----
COEFKZSR (REAL)
    TIRE SPRING RATE
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
2923 2923
-----
NCZ       (INTEGER)
    NO. OF DEF POINTS
    TIRE VERTICAL DAMPER
ENTER    1 INTEGER VALUE(S)
2
-----
COEFCZV  (REAL)
    TIRE VERT VELOCITY
ENTER  2 REAL VALUE(S)
?
-100 100
-----
COEFCZDR (REAL)
                                                       MORE...
    TIRE DAMPING RATE
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
15 15
-----
FRIC      (Y OR N)
    GROUND FRICTION
ENTER 1 Y OR N VALUE
Y
-----
BRAKE     (Y OR N)
    BRAKES ON
ENTER 1 Y OR N VALUE
N
-----
SCOX      (REAL)
    LONG SCRUBBING COEFF

ENTER 1 REAL VALUE
?
                                                       MORE...
```

```
32.472
-----
SCOY      (REAL)
    LAT SCRUBBING COEFF
ENTER 1 REAL VALUE
?
48.709
***************************************************************************
INPUT FOR STRUCTURAL     COMPONENT CLG2. LANDING GEAR

  1 NAMEZS    - STRUT Z-TRANSLATION =     TRAZ1030
  2 NAMEXS    - STRUT X-TRANSLATION =     TRAX1030
  3 NAMEYS    - STRUT Y-TRANSLATION =     TRAY1030
  4 NAMEAX    - STRUT X-ROTATION    =     ROTX1030
  5 NAMEAY    - STRUT Y-ROTATION    =     ROTY1030
  6 NAMEDL    - STRUT ELONGATION    =     LSTR1030
  7 M1        - TIRE MASS           =  2.50000E-01
  8 M2        - STRUT MASS          =  1.00000E-01
  9 L0        - UNDEFORMED LENGTH   =  6.48900E+01
 10 ZCOS      - (REAL) STRUT Z-TRAN DIR COS
              0.00000E+00  2.74300E-01  9.61600E-01
 11 XCOS      - (REAL) STRUT X-TRAN DIR COS
                                                                   MORE...
              1.00000E+00  0.00000E+00  0.00000E+00
 12 NKL       - NO. OF DEF POINTS   =            2
 13 COEFKLSL  - STRUT DISPLACEMENT  = -1.00000E+01  1.00000E+01
 14 COEFKLSR  - STRUT SPRING RATE   =  7.20000E+02  7.20000E+02
 15 NCL       - NO. OF DEF POINTS   =            2
 16 COEFCLV   - STRUT VELOCITY      = -1.00000E+02  1.00000E+02
 17 COEFCLDR  - STRUT DAMPING RATE  =  0.00000E+00  0.00000E+00
 18 NKX       - NO. OF DEF POINTS   =            2
 19 COEFKXLD  - TIRE LONG DISPLACEMT= -1.00000E+01  1.00000E+01
 20 COEFKXSR  - TIRE SPRING RATE    =  1.50300E+03  1.50300E+03
 21 NCX       - NO. OF DEF POINTS   =            2
 22 COEFCXV   - TIRE LONG VELOCITY  = -1.00000E+02  1.00000E+02
 23 COEFCXDR  - TIRE DAMPING RATE   =  1.50000E+01  1.50000E+01
 24 NKY       - NO. OF DEF POINTS   =            2
 25 COEFKYLD  - TIRE LAT DISPLACEMT = -1.00000E+01  1.00000E+01
 26 COEFKYSR  - TIRE SPRING RATE    =  1.39100E+03  1.39100E+03
 27 NCY       - NO. OF DEF POINTS   =            2
 28 COEFCYV   - TIRE LAT VELOCITY   = -1.00000E+02  1.00000E+02
 29 COEFCYDR  - TIRE DAMPING RATE   =  1.50000E+01  1.50000E+01
 30 NKZ       - NO. OF DEF POINTS   =            2
 31 COEFKZVD  - TIRE VERT DISPLACEMT= -1.00000E+01  1.00000E+01
 32 COEFKZSR  - TIRE SPRING RATE    =  2.92300E+03  2.92300E+03
                                                                   MORE...
```

```
33 NCZ       - NO. OF DEF POINTS    =              2
34 COEFCZV   - TIRE VERT VELOCITY   = -1.00000E+02  1.00000E+02
35 COEFCZDR  - TIRE DAMPING RATE    =  1.50000E+01  1.50000E+01
36 FRIC      - GROUND FRICTION      =          YES
37 BRAKE     - BRAKES ON            =          NO
38 SCOX      - LONG SCRUBBING COEFF=  3.24720E-01
39 SCOY      - LAT SCRUBBING COEFF =  4.87090E-01
**********************************************************************

RE-ENTER (Y OR N)
N
DATA SET ACAPSTAR FOR CLG2 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
```

2.2.15 CLS2 - Modal Lifting Surface.

2.2.15.1 CLS2 User Notes - Elastic modes must be defined along the principal axis, but modal interpolation is performed to allow implicit coupling with degrees of freedom defined at node points in the plane of the structure, but not on the principal axis or coincident with the mode shape stations. Modes must be obtained from a separate analysis (see paragraph 2.2.1.1, CFM2 User Notes).

For ease of input, wing inertias may be defined with respect to the CG or the attachment point. Likewise, aileron inertias may be defined with respect to the aileron CG or the hinge.

The user has the option of choosing a left- or right-handed coordinate system for the structure. If the symmetry option is elected, an opposite-handed coordinate system will be automatically defined for the additional structure so that degree of freedom definitions will be consistent, i.e., positive Z direction defined in the same direction for both halves of the structure, positive X outboard, positive Y aft.

2.2.15.2 CLS2 Sample Input - Input is shown for a data set for which a left side (PORT) orientation has been selected for the initial coordinate definition (right-handed coordinate system). Motion of the wing has been restricted to out-of-plane degrees of freedom, and a control surface has been defined aft of the spanwise axis. Two implicit degrees of freedom, which could represent stores or additional structure, have been defined at the wing tip. The orientation of the local X, Y vectors coincides with that of the wing coordinate system vectors. The symmetry option has been used to create a corresponding "right side" structure.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CLS2
DATA SET
WNGAIL
SAVE FILE(R,U1,...)
U1

STRUCTURAL COMPONENT CLS2 . MODAL LIFTING SURFACE

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
WING - AILERON COMBINATION
-----
WING      (ALPHA)
   PORT OR STARBOARD
   ENTER PORT OR STAR
   PORT ASSUMED IF OTHER THAN PORT OR STAR IS ENTERED
ENTER  4 CHARACTERS (68/LINE)
                                                     MORE...
PORT
-----
RBM       (Y OR N)
   RIGID BODY MODES
ENTER 1 Y OR N VALUE
Y
-----
ISTA      (Y OR N)
   STATIONWISE (X)
ENTER 1 Y OR N VALUE
N
-----
ICHORD    (Y OR N)
   CHORDWISE (Y)
ENTER 1 Y OR N VALUE
N
-----
IOP       (Y OR N)
   OUT OF PLANE (Z)
ENTER 1 Y OR N VALUE
Y
-----
```

```
IPITCH    (Y OR N)
    PITCHING (X--X)
ENTER 1 Y OR N VALUE
N
-----
IFLAP     (Y OR N)
    FLAPPING (Y--Y)
ENTER 1 Y OR N VALUE
Y
-----
ISWEEP    (Y OR N)
    SWEEPING (Z--Z)
ENTER 1 Y OR N VALUE
N
-----
ATTXY     (REAL)
    WING ATTACH NODE XY
    X Y COORDINATES OF ROOT OF WING ELASTIC AXIS (IN)
    RIGID BODY DOF DEFINED HERE
NULL VECTOR (Y OR N)
Y
-----
                                                               MORE...
AILERON   (Y OR N)
    CONTROL SURF OPTION
ENTER 1 Y OR N VALUE
Y
-----
AILCG     (REAL)
    AILERON CG XY (IN)
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
15 -7
-----
AILCI     (Y OR N)
    REFERENCE AXES AT CG
    YES= INERTIAS ABOUT AILERON CG
    NO = INERTIAS ABOUT AILERON HINGE
ENTER 1 Y OR N VALUE
Y
-----
AILINERT (REAL)
    AILERON INERTIAS
```

```
    1. MASS (LB)
    2. IXX  (LB-IN**2) MOI ABOUT HINGE/AXIS THROUGH CG
    3. IYY  MOI ABOUT AXIS THROUGH CG
    4. IZZ  MOI ABOUT OUT-OF-PLANE AXIS AT HINGE/CG
    5. IYZ
NULL VECTOR (Y OR N)
N
ENTER  5 REAL VALUE(S)
?
2 4 6 8 10
-----
HINGE    (REAL)
    REACTION POINTS
    ROW1-- INBOARD X Y
    ROW2-- OUTBOARD X Y
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
N
                                                             MORE...
PREPARE TO ENTER ROW  1
ENTER  2 REAL VALUES
?
12 -5
PREPARE TO ENTER ROW  2
ENTER  2 REAL VALUES
?
17 -7
-----
WINGCG   (REAL)
    WING CG XY (IN) .
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
10 1
-----
WINGCI   (Y OR N)
    REFERENCE AXES AT CG
    YES= INERTIAS ABOUT WING CG
    NO = INERTIAS ABOUT ATTACH NODE
ENTER 1 Y OR N VALUE
                                                             MORE...
```

```
Y
-----
WINGINER (REAL)
    WING INERTIAS
    1. MASS (LB)   2. IXX   3. IYY   4. IZZ   5. IXY   6. IYZ
    (LB-IN**2)
NULL VECTOR (Y OR N)
N
ENTER  6 REAL VALUE(S)
?
3 5 7 9 11 13
-----
NMODE    (INTEGER)
    NO. OF ELASTIC MODES
ENTER    1 INTEGER VALUE(S)
2
-----
NSTA     (INTEGER)
    NO. MODAL STATIONS
ENTER    1 INTEGER VALUE(S)
5
-----
                                                          MORE...
MSTAT    (REAL)
    MODE SHAPE STATIONS
NULL VECTOR (Y OR N)
N
ENTER  5 REAL VALUE(S)
?
0 5 10 15 20
-----
IPCOMP   (Y OR N)
    IP COMPONENTS
ENTER 1 Y OR N VALUE
N
-----
OPCOMP   (Y OR N)
    OP COMPONENTS
ENTER 1 Y OR N VALUE
Y
-----
TORCOMP  (Y OR N)
    TORSION COMPONENTS
ENTER 1 Y OR N VALUE
N
                                                          MORE...
```

```
-----
OPMODE   (REAL)
    MODES OP COMPONENT
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  5 REAL VALUES
?
0 -.5 -1 -.5 0
PREPARE TO ENTER ROW  2
ENTER  5 REAL VALUES
?
0 1 0 -1 0
-----
OPSLOP   (REAL)
    OP SLOPES
TYPE MATRIX
                                                                MORE...
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  5 REAL VALUES
?
-.05 -.025 0 .025 .05
PREPARE TO ENTER ROW  2
ENTER  5 REAL VALUES
?
.1 0 -.1 0 .1
-----
MODINERT (REAL)
    MODAL PROPERTIES
    COLUMN 1. MODAL MASS --2. DAMPING --3. FREQUENCY
    NMODE ROWS
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
                                                                MORE...
```

```
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  3 REAL VALUES
?
.05 .08 111
PREPARE TO ENTER ROW  2
ENTER  3 REAL VALUES
?
.02 .03 555
-----
NAUX      (INTEGER)
    NO. OF AUX NODES
    OPTIONAL AUXILIARY  NODES AT WHICH IMPLICIT DOFS ARE DEFINED
    THEY NEED NOT BEAR ANY RELATION TO MODE STATIONS
ENTER    1 INTEGER VALUE(S)
1
-----
XYAUX    (REAL)
    XY FOR EACH AUX NODE
                                                           MORE...
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  2 REAL VALUES
?
20 0
-----
NODOF    (Y OR N)
    DOF Y OR N FOR NODES
    COLUMNS---Y OR N FOR XAUX YAUX ZAUX PAUX FAUX SAUX
    6 COLUMNS, NAUX ROWS
PREPARE TO ENTER ROW   1
ENTER    6 Y OR N VALUES (35A2)
N N Y N Y N
-----
LOCVEC   (REAL)
    LOCAL XY VECTORS
                                                           MORE...
```

```
    DIRECTION COSINES FOR LOCAL XY VECTORS
    WRT WING COORDINATE SYSTEM
    6 COLUMNS, NAUX ROWS
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
R
OPTION TO SPECIFY NULL ROWS (Y OR N)
N
PREPARE TO ENTER ROW  1
ENTER  6 REAL VALUES
?
1 0 0 0 1 0
-----
YZSYMM   (Y OR N)
    SYMMETRY OPTION
    OPTION TO CREATE IDENTICAL WING CHIRALLY REFLECTED
    THROUGH YZ SYMMETRY PLANE
ENTER 1 Y OR N VALUE
Y
*********************************************************************
                                                             HOLDING
INPUT FOR STRUCTURAL     COMPONENT CLS2. MODAL LIFTING SURFACE

  1 WING       - PORT OR STARBOARD   =PORT
  2 RBM        - RIGID BODY MODES    =          YES
  3 ISTA       - STATIONWISE (X)     =          NO
  4 ICHORD     - CHORDWISE (Y)       =          NO
  5 IOP        - OUT OF PLANE (Z)    =          YES
  6 IPITCH     - PITCHING (X--X)     =          NO
  7 IFLAP      - FLAPPING (Y--Y)     =          YES
  8 ISWEEP     - SWEEPING (Z--Z)     =          NO
  9 ATTXY      - WING ATTACH NODE XY =  0.00000E+00  0.00000E+00
 10 AILERON    - CONTROL SURF OPTION =          YES
 11 AILCG      - AILERON CG XY (IN)  =  1.50000E+01 -7.00000E+00
 12 AILCI      - REFERENCE AXES AT CG=          YES
 13 AILINERT   - (REAL) AILERON INERTIAS
               2.00000E+00  4.00000E+00  6.00000E+00  8.00000E+00
               1.00000E+01
 14 HINGE      - (REAL) REACTION POINTS
             GENERAL MATRIX

    ROW     1
          1.20000E+01 -5.00000E+00
                                                             MORE...
```

```
   ROW     2
        1.70000E+01 -7.00000E+00
15 WINGCG    - WING CG XY (IN) .   =  1.00000E+01  1.00000E+00
16 WINGCI    - REFERENCE AXES AT CG=         YES
17 WINGINER  - (REAL) WING INERTIAS
             3.00000E+00  5.00000E+00  7.00000E+00  9.00000E+00
             1.10000E+01  1.30000E+01
18 NMODE     - NO. OF ELASTIC MODES=            2
19 NSTA      - NO. MODAL STATIONS  =            5
20 MSTAT     - (REAL) MODE SHAPE STATIONS
             0.00000E+00  5.00000E+00  1.00000E+01  1.50000E+01
             2.00000E+01
21 IPCOMP    - IP COMPONENTS       =         NO
22 OPCOMP    - OP COMPONENTS       =         YES
23 TORCOMP   - TORSION COMPONENTS  =         NO
24 OPMODE    - (REAL) MODES OF COMPONENT
          GENERAL MATRIX

   ROW     1
        0.00000E+00 -5.00000E-01 -1.00000E+00 -5.00000E-01
        0.00000E+00
   ROW     2
                                                       MORE...
        0.00000E+00  1.00000E+00  0.00000E+00 -1.00000E+00
        0.00000E+00
25 OPSLOP    - (REAL) OP SLOPES
          GENERAL MATRIX

   ROW     1
       -5.00000E-02 -2.50000E-02  0.00000E+00  2.50000E-02
        5.00000E-02
   ROW     2
        1.00000E-01  0.00000E+00 -1.00000E-01  0.00000E+00
        1.00000E-01
26 MODINERT - (REAL) MODAL PROPERTIES
          GENERAL MATRIX

   ROW     1
        5.00000E-02  8.00000E-02  1.11000E+02
   ROW     2
        2.00000E-02  3.00000E-02  5.55000E+02
27 NAUX      - NO. OF AUX NODES    =            1
28 XYAUX     - (REAL) XY FOR EACH AUX NODE
          GENERAL MATRIX

                                                       MORE...
```

```
    ROW     1
           2.00000E+01  0.00000E+00
 29 NODOF      - DOF Y OR N FOR NODES
ROW       1
            NO   NO   YES NO   YES NO
 30 LOCVEC    - (REAL) LOCAL XY VECTORS
            GENERAL MATRIX

    ROW     1
           1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           1.00000E+00  0.00000E+00
 31 YZSYMM    - SYMMETRY OPTION      =           YES
**********************************************************************

RE-ENTER (Y OR N)
N
DATA SET WNGAIL   FOR CLS2 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
```

2.2.16 CGLØ - Global Transformation.

2.2.16.1 CGLØ User Notes - The user is asked to specify the model sequence numbers of the data sets for which transformation of the global acceleration vector to the component coordinate system is required. The sequence numbers of data sets which specify null component mass matrices need not be included. Sequence numbers are found in the column labeled INDEX in the listing of a model data set.

2.2.16.2 CGLØ Sample Input - In this example, the component X and Y coordinate axes are coincident with the global coordinate axes.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CGL0
DATA SET
TGC
SAVE FILE(R,U1,...)
U1

COMPONENT CGL0. GLOBAL REFERENCE

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
TRANSFORM GLOBAL ACCELERATIONS TO COMPONENT COORDS
-----
NCGL      (INTEGER)
    NO. OF COMPONENTS
    FOR WHICH GLOBAL TRANSFORM WILL BE PERFORMED
ENTER    1 INTEGER VALUE(S)
2
                                                            MORE...
-----
IGSEQ     (INTEGER)
    SEQUENCE NUMBERS
    OF COMPONENTS SELECTED
ENTER    2 INTEGER VALUE(S)
1 4
-----
XYDG      (REAL)
    COMPONENT X,Y VECTOR
    IN TERMS OF GLOBAL SYSTEM
TYPE MATRIX
(0=NULL),(3=GENERAL)
3
INPUT BY ROWS OR COLUMNS (R OR C)
C
OPTION TO SPECIFY NULL COLUMNS (Y OR N)
N
PREPARE TO ENTER COL  1
ENTER  6 REAL VALUES
?
1 0 0 0 1 0
PREPARE TO ENTER COL  2
                                                            MORE...
```

```
ENTER  6 REAL VALUES
?
1 0 0 0 1 0
-----
CDFLI    (DOF)
    DOF NAME
ENTER 1 DOF VALUE (A4,I4)
X
**********************************************************************
INPUT FOR COMPONENT CGL0. GLOBAL REFERENCE

  1 NCGL      - NO. OF COMPONENTS    =           2
  2 IGSEQ     - SEQUENCE NUMBERS     =           1             4
  3 XYDG      - (REAL) COMPONENT X,Y VECTOR
           GENERAL MATRIX

    ROW    1
         1.00000E+00  1.00000E+00
    ROW    2      NULL ROW
    ROW    3      NULL ROW
    ROW    4      NULL ROW
    ROW    5
                                                                MORE...
         1.00000E+00  1.00000E+00
    ROW    6      NULL ROW
  4 CDFLI     - DOF NAME             =      X      0
**********************************************************************

RE-ENTER (Y OR N)
N
DATA SET TGC      FOR CGL0 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
```

2.2.17 CSF3 - Nonlinear Spring, Damper System.

2.2.17.1 CSF3 User Notes - See paragraph 2.2.6.1, CSF1 User Notes.

2.2.17.2 CSF3 Sample Input - The following single degree of freedom nonlinear equation is input:

$$\ddot{X} + 3X\dot{X} + X^3 = 0$$

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
CSF3
DATA SET
NONLIN
SAVE FILE(R,U1,...)
U1


COMPONENT CSF3. NONLINEAR FINITE ELEMENT

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
NONLINEAR EQUATION
-----
NCDF      (INTEGER)
    NO. OF DOF
ENTER     1 INTEGER VALUE(S)
1
------
                                                                    MORE...
CDFLI     (DOF)
    DOF NAMES
ENTER 1 DOF VALUE (A4,I4)
X
------
CM        (REAL)
    M
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
1
INPUT      1 DIAGONAL REAL VALUES
?
1
-----
CC        (REAL)
    C
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
0
------
CK        (REAL)
    K
                                                                    MORE...
```

```
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
0
-----
CC2       (REAL)
    C2
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
0
-----
CC3       (REAL)
    C3
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
0
-----
CK2       (REAL)
    K2
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
0
-----
                                                            MORE...
CK3       (REAL)
    K3
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
1
INPUT      1 DIAGONAL REAL VALUES
?
1
-----
CA        (REAL)
    A
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
0
-----
CB        (REAL)
    B
TYPE MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
0
-----
CD        (REAL)
                                                            MORE...
```

```
     D
TYPE  MATRIX
(0=NULL), (1=DIAGONAL),  (2=SYMMETRIC), (3=GENERAL)
1
INPUT      1 DIAGONAL REAL VALUES
?
3
-----
CF          (REAL)
    F
ENTER  1 REAL VALUE(S)
?
0
-----
IGR        (Y OR N)
    GLOBAL REFERENCE
ENTER 1 Y OR N VALUE
N
*******************************************************************
INPUT FOR COMPONENT CSF3. NONLINEAR FINITE ELEMENT

   1 NCDF      - NO. OF DOF           =              1
                                                              MORE...
   2 CDFLI     - DOF NAMES            =       X      0
   3 CM        - (REAL) M
            DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

       1.00000E+00
   4 CC        - (REAL) C
            NULL MATRIX

   5 CK        - (REAL) K
            NULL MATRIX

   6 CC2       - (REAL) C2
            NULL MATRIX

   7 CC3       - (REAL) C3
            NULL MATRIX

   8 CK2       - (REAL) K2
            NULL MATRIX

   9 CK3       - (REAL) K3
            DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)
                                                              MORE...
```

```
     1.00000E+00
 10 CA          - (REAL) A
             NULL MATRIX

 11 CB          - (REAL) B
             NULL MATRIX

 12 CD          - (REAL) D
             DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

     3.00000E+00
 13 CF          - F                        =  0.00000E+00
 14 IGR         - GLOBAL REFERENCE         =          NO
**********************************************************************

RE-ENTER (Y OR N)
N
DATA SET NONLIN   FOR CSF3 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
```

2.3 FORCE DATA SETS

Input data for a force is formed using the NEW command or its variations (new data sets may be input during model formulation and the addition phase of model editing) or by editing an existing force data set. In the examples which follow, the NEW command has been used to form sample data sets. The user should refer directly to paragraph 3.2 of the DYSCO 4.1 User's Manual while reviewing the sample dialogues.

2.3.1 FSS1 - Sinusoidal Shaker.

2.3.1.1 FSS1 User Notes - FSS1 is limited to continuous application to CSF1 degrees of freedom, and the same forcing function can be applied to any degree of freedom using CGF2. The force amplitude (units: lb, in.-lb, etc.) is determined by the degree of freedom to which it is applied.

2.3.1.2 FSS1 Sample Input -

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
FSS1
DATA SET
SHAKER
SAVE FILE(R,U1,...)
U1

FORCE FSS1 . SINUSOIDAL SHAKER

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
SHAKER
-----
DOF       (DOF)
    DOF FORCED BY SHAKER
ENTER 1 DOF VALUE (A4,I4)
X   1
-----
                                                              MORE...
FREQ      (REAL)
    FREQUENCY (HZ)
ENTER 1 REAL VALUE
?
10
-----
COSC      (REAL)
    COSINE COMPONENT
ENTER 1 REAL VALUE
?
1
-----
SINC      (REAL)
    SINE COMPONENT
ENTER 1 REAL VALUE
?
2
*********************************************************************
INPUT FOR FORCE FSS1. SINUSOIDAL SHAKER

  1 DOF       - DOF FORCED BY SHAKER=      X    1000
  2 FREQ      - FREQUENCY (HZ)      =  1.00000E+01
                                                              MORE...
```

```
  3 COSC       - COSINE COMPONENT     =  1.00000E+00
  4 SINC       - SINE COMPONENT       =  2.00000E+00
*********************************************************************
RE-ENTER (Y OR N)
N
DATA SET SHAKER   FOR FSS1 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
```

2.3.2 FRAØ - Rotor Aerodynamics, Linear (2-d).

2.3.2.1 FRAØ User Notes - FRAØ may be used with any of the rotor component modules. The lift, drag, and pitching moment distributions are identical for each blade, but factors can be multiplied times C_L, C_D, or C_M at points along the blades to simulate blade cutouts, tip loss effects, or other losses. The factors are applied identically to each blade in the system. Note: When an aerodynamics data set is used in conjunction with a trim solution (STR3), the wind velocity in the data set must be set to zero.

2.3.2.2 FRAØ Sample Input - Input for an FRAØ data set follows. The user must specify at least two aerodynamic factor stations (nondimensional), and the list of stations must start with zero and end with one. If no factors are desired, a factor of one is specified at stations zero and one. Between factor stations the factors are linearly interpolated.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
FRA0
DATA SET
B AERO
SAVE FILE(R,U1,...)
U1


FORCE FRA0 . ROTOR AERO LINEAR

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
2-D LINEAR BLADE AERO
-----
VAIR      (REAL)
    WIND VELOCITY
    VX,VY,VZ (FT/SEC) IN HUB SYSTEM
NULL VECTOR (Y OR N)
Y
                                                                MORE...
-----
ALAMDA    (REAL)
    AVG INDUCED VELOCITY
    POS UP HUB REF
ENTER 1 REAL VALUE
?
-.012
-----
ILINEA    (Y OR N)
    INDUCED VLCTY VARIES
ENTER 1 Y OR N VALUE
N
-----
XAC       (REAL)
    A/C OFFSET FROM F.A.
    +FWD (PERCENT OF CHORD)
ENTER 1 REAL VALUE
?
0
-----
A0        (REAL)
    LIFT CURVE SLOPE
                                                                MORE...
```

```
    (1/DEG)
ENTER 1 REAL VALUE
?
.1
-----
ALOL      (REAL)
    ALPHA FOR ZERU LIFT
    (DEG)
ENTER 1 REAL VALUE
?
0
-----
CD0       (REAL)
    DRAG COEFFICIENT
ENTER 1 REAL VALUE
?
.0085
-----
CM0       (REAL)
    MOMENT COEFFICIENT
ENTER 1 REAL VALUE
?
                                                            MORE...
0
-----
ASTALL    (REAL)
    POS STALL ANGLE
    (DEG)
ENTER 1 REAL VALUE
?
25
-----
NXA       (INTEGER)
    # OF AERO STATIONS
ENTER    1 INTEGER VALUE(S)
12
-----
XSTA      (REAL)
    NON-DIMENSL STATIONS
NULL VECTOR (Y OR N)
N
ENTER 12 REAL VALUE(S)
?
.177 .225 .4 .6 .7 .75 .8 .85 .9 .935 .97 1
-----
                                                            MORE...
```

```
CHORD     (REAL)
    CHORD FOR STATIONS
NULL VECTOR (Y OR N)
N
ENTER 12 REAL VALUE(S)
?
27 27 27 27 27 27 27 27 27 27 27 27
-----
NY        (INTEGER)
    # OF FACTOR STATIONS
ENTER    1 INTEGER VALUE(S)
2
-----
XF        (REAL)
    NON-DIMENSL STATIONS
ENTER  2 REAL VALUE(S)
?
0 1
-----
FL        (REAL)
    FACTORS FOR CL
NULL VECTOR (Y OR N)
                                                            MORE...
N
ENTER  2 REAL VALUE(S)
?
1. 1
-----
FD        (REAL)
    FACTORS FOR CD
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
1 1
-----
FM        (REAL)
    FACTORS FOR CM
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
1 1
******************************************************************
INPUT FOR FORCE FRA0. ROTOR AERO LINEAR
                                                            MORE...
```

```
  1 VAIR       - (REAL) WIND VELOCITY
               0.00000E+00  0.00000E+00  0.00000E+00
  2 ALAMDA     - AVG INDUCED VELOCITY= -1.20000E-02
  3 ILINEA     - INDUCED VLCTY VARIES=        NO
  4 XAC        - A/C OFFSET FROM F.A.=  0.00000E+00
  5 A0         - LIFT CURVE SLOPE     =  1.00000E-01
  6 ALOL       - ALPHA FOR ZERO LIFT =  0.00000E+00
  7 CD0        - DRAG COEFFICIENT     =  8.50000E-03
  8 CM0        - MOMENT COEFFICIENT  =  0.00000E+00
  9 ASTALL     - POS STALL ANGLE      =  2.50000E+01
 10 NXA        - # OF AERO STATIONS   =           12
 11 XSTA       - (REAL) NON-DIMENSL STATIONS
               1.77000E-01  2.25000E-01  4.00000E-01  6.00000E-01
               7.00000E-01  7.50000E-01  8.00000E-01  8.50000E-01
               9.00000E-01  9.35000E-01  9.70000E-01  1.00000E+00
 12 CHORD      - (REAL) CHORD FOR STATIONS
               2.70000E+01  2.70000E+01  2.70000E+01  2.70000E+01
               2.70000E+01  2.70000E+01  2.70000E+01  2.70000E+01
               2.70000E+01  2.70000E+01  2.70000E+01  2.70000E+01
 13 NY         - # OF FACTOR STATIONS=            2
 14 XF         - NON-DIMENSL STATIONS=  0.00000E+00  1.00000E+00
                                                            MORE...
 15 FL         - FACTORS FOR CL       =  1.00000E+00  1.00000E+00
 16 FD         - FACTORS FOR CD       =  1.00000E+00  1.00000E+00
 17 FM         - FACTORS FOR CM       =  1.00000E+00  1.00000E+00
**************************************************************************

RE-ENTER (Y OR N)
N
DATA SET B AERO   FOR FRA0 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
```

2.3.3 FRA2 - Rotor Aerodynamics, Tabular (2-d).

2.3.3.1 FRA2 User Notes - FRA2 may be used with any of the rotor component modules. The airfoil tables required by an FRA2 data set are automatically listed in the model ds. The lift, drag, and pitching moment distributions are identical for each blade, but factors can be multiplied times C_L, C_D, or C_M at points along the blades to simulate blade cutouts, tip loss effects, or other losses. The factors are applied identically to each blade in the system. Note: When an aerodynamics data set is used in conjunction with a trim solution (STR3), the wind velocity in the data set must be set to zero.

2.3.2.2 FRA2 Sample Input - Input for an FRA2 data set follows. The user must specify at least two aerodynamic factor stations (nondimensional), and the list of stations must start with zero and end with one. If no factors are desired, a factor of one is specified at stations zero and one. Between factor stations the factors are linearly interpolated. In this example, the coefficients have been set to zero between the blade root and station .177 and allowed to vary linearly from zero to their original values between stations .177 and .225, remaining at the original values as far as station .97. From station .97 to the blade tip, the coefficients are linearly reduced to zero.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
FRA2
DATA SET
B AERO
SAVE FILE(R,U1,...)
U1

FORCE FRA2 . ROTOR AERO TABULAR

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
2-D TABULAR BLADE AERO
------
VAIR      (REAL)
    WIND VELOCITY
    VX, VY, VZ, W.R.T. HUB SYS  (FT/SEC)
NULL VECTOR (Y OR N)
N
                                                              MORE...
ENTER  3 REAL VALUE(S)
?
159.48 0 -6.099
------
ALAMDA    (REAL)
    NONDIM INDUCED VEL
    +UPWARD (AVERAGE)
ENTER 1 REAL VALUE
?
-.01041
------
INDUC     (INTEGER)
    INDUCED VEL TYPE
ENTER     1 INTEGER VALUE(S)
1
------
NXA       (INTEGER)
    NO. AERO STAS
ENTER     1 INTEGER VALUE(S)
12
------
SAERO     (REAL)
                                                              MORE...
```

```
    NONDIM AERO STAS
ENTER 12 REAL VALUE(S)
?
.177 .225 .4 .6 .7 .75 .8 .85 .9 .935 .97 1
------
NUMAF     (INTEGER)
    NO. AIRFOIL TABLES
ENTER     1 INTEGER VALUE(S)
1
------
AFTAB1    (AIRFOIL DS)
    NAME AF TABLE 1
ENTER AIRFOIL DATASET NAME
AFD161
------
NUMAF1    (INTEGER)
    NO. STAS AF 1
ENTER     1 INTEGER VALUE(S)
12
------
STA-AF1   (INTEGER)
    STAS AF 1
                                                                  MORE...
NULL VECTOR (Y OR N)
N
ENTER    12 INTEGER VALUE(S)
1 2 3 4 5 6 7 8 9 10 11 12
------
XAC       (REAL)
    A/C OFFSET FROM F.A.
    +FWD (PERCENT OF CHORD)
ENTER 1 REAL VALUE
?
0
------
CHORD     (REAL)
    CHORD (IN)
NULL VECTOR (Y OR N)
N
ENTER 12 REAL VALUE(S)
?
27 27 27 27 27 27 27 27 27 27 27 27
------
NX        (INTEGER)
    NO. AERO FACTOR STAS
                                                                  MORE...
```

```
ENTER    1 INTEGER VALUE(S)
5
-----
XF        (REAL)
    NONDIM FACTOR STAS
ENTER  5 REAL VALUE(S)
?
0 .177 .225 .97 1
-----
FL        (REAL)
    FACTORS FOR CL
NULL VECTOR (Y OR N)
N
ENTER  5 REAL VALUE(S)
?
0 0 1 1 0
-----
FD        (REAL)
    FACTORS FOR CD
NULL VECTOR (Y OR N)
N
ENTER  5 REAL VALUE(S)
                                                                  MORE...
?
0 0 1 1 0
-----
FM        (REAL)
    FACTORS FOR CM
NULL VECTOR (Y OR N)
N
ENTER  5 REAL VALUE(S)
?
0 0 1 1 0
*******************************************************************
INPUT FOR FORCE FRA2. ROTOR AERO TABULAR

  1 VAIR      - (REAL) WIND VELOCITY
                1.59480E+02  0.00000E+00 -6.09900E+00
  2 ALAMDA    - NONDIM INDUCED VEL   = -1.04100E-02
  3 INDUC     - INDUCED VEL TYPE     =           1
  4 NXA       - NO. AERO STAS        =          12
  5 SAERO     - (REAL) NONDIM AERO STAS
                1.77000E-01  2.25000E-01  4.00000E-01  6.00000E-01
                7.00000E-01  7.50000E-01  8.00000E-01  8.50000E-01
                9.00000E-01  9.35000E-01  9.70000E-01  1.00000E+00
                                                                  MORE...
```

```
 6 NUMAF       - NO. AIRFOIL TABLES   =              1
 7 AFTAB1      - NAME AF TABLE 1      = AFD161  /AIRFOIL
 8 NUMAF1      - NO. STAS AF 1        =             12
 9 STA-AF1     - STAS AF 1
                      1            2            3            4            5
                      6            7            8            9           10
                     11           12
10 XAC         - A/C OFFSET FROM F.A.=  0.00000E+00
11 CHORD       - (REAL) CHORD (IN)
                 2.70000E+01  2.70000E+01  2.70000E+01  2.70000E+01
                 2.70000E+01  2.70000E+01  2.70000E+01  2.70000E+01
                 2.70000E+01  2.70000E+01  2.70000E+01  2.70000E+01
12 NX          - NO. AERO FACTOR STAS=              5
13 XF          - (REAL) NONDIM FACTOR STAS
                 0.00000E+00  1.77000E-01  2.25000E-01  9.70000E-01
                 1.00000E+00
14 FL          - (REAL) FACTORS FOR CL
                 0.00000E+00  0.00000E+00  1.00000E+00  1.00000E+00
                 0.00000E+00
15 FD          - (REAL) FACTORS FOR CD
                 0.00000E+00  0.00000E+00  1.00000E+00  1.00000E+00
                 0.00000E+00
                                                                  MORE...
16 FM          - (REAL) FACTORS FOR CM
                 0.00000E+00  0.00000E+00  1.00000E+00  1.00000E+00
                 0.00000E+00
*******************************************************************
RE-ENTER (Y OR N)
N
DATA SET B AERO   FOR FRA2 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
```

2.3.4 FRA3 - Rotor Aerodynamics, General.

2.3.4.1 FRA3 User Notes - FRA3 may be used with any of the rotor component modules, but is primarily suited for use with CRE3 and CRD3. The steady state lift, drag, and pitching moment coefficients can be calculated automatically or be obtained from airfoil tables. The same airfoil table can be used with FRA3 and FRA2 data sets, and the tables required by a force data set are automatically listed in the model ds. The lift, drag, and pitching moment distributions are identical for each blade, but factors can be multiplied times C_L, C_D, or C_M at points along the blades to simulate blade cutouts, tip loss effects, or other losses. The factors are applied identically to each blade in the system. Note: When an aerodynamics data set is used in conjunction with a trim solution (STR3), the wind velocity in the data set must be set to zero.

2.3.4.2 FRA3 Sample Input - Input is shown for the FRA3 data set used in the helicopter simulation presented in Section 6 of the User's Manual (FCT1.65/FRA3). The user must specify at least two aerodynamic factor stations (nondimensional), and the list of stations must start with zero and end with one. If no factors are desired, a factor of one is specified at stations zero and one. Between factor stations the factors are linearly interpolated.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
FRA3
DATA SET
FCT1.65
SAVE FILE(R,U1,...)
U1


FORCE FRA3 . ROTOR AERO GENERAL

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
GENERAL AERO, INDUCED VEL 1.65
-----
IEQS      (Y OR N)
    AERODYNAMICS BY EQS
ENTER 1 Y OR N VALUE
N
-----
                                                              MORE...
INFTAB    (Y OR N)
    INDUCED VEL BY TABLE
ENTER 1 Y OR N VALUE
N
-----
IUNSTD    (Y OR N)
    UNSTEADY AERO
ENTER 1 Y OR N VALUE
N
-----
VAIRH     (REAL)
    WIND VELOCITY
    VX, VY, VZ, W.R.T. HUB SYS  (FT/SEC)
NULL VECTOR (Y OR N)
Y
-----
ASTALL    (REAL)
    STALL ANGLE (DEG)
ENTER 1 REAL VALUE
?
20
-----
                                                              MORE...
```

```
RFCT      (REAL)
    INDUCED VEL FACTOR
ENTER 1 REAL VALUE
?
1.65
-----
TIPLOC    (REAL)
    TIP LOSS COEFFICIENT
ENTER 1 REAL VALUE
?
.95
-----
XH        (REAL)
    HUB EXTENT (IN)
ENTER 1 REAL VALUE
?
3.96
-----
ALT       (REAL)
    VEHICLE HEIGHT (FT)
ENTER 1 REAL VALUE
?
                                                              MORE...
200
-----
K27       (REAL)
    TIP VORTEX COEFF
ENTER 1 REAL VALUE
?
0
-----
CD0       (REAL)
    BLADE DRAG COEFFAT
    ALFA=0, M=.3
ENTER 1 REAL VALUE
?
.0068
-----
Q1C       (REAL)
    Q1C COEFFICIENT
    MEFF=M*(COS Q1C*GAMA)**Q2C
ENTER 1 REAL VALUE
?
1
-----
                                                              MORE...
```

```
Q2C       (REAL)
    Q2C COEFFICIENT
    MEFF=M*(COS Q1C*GAMA)**Q2C
ENTER 1 REAL VALUE
?
.5
-----
ALAMDA    (REAL)
    NONDIM INDUCED VEL
    POSITIVE UPWARD
ENTER 1 REAL VALUE
?
-.012
-----
NXA       (INTEGER)
    NO. OF STATIONS
ENTER     1 INTEGER VALUE(S)
12
-----
XAERO     (REAL)
    NONDIM AERO STATIONS
ENTER 12 REAL VALUE(S)
                                                              MORE...
?
.177 .225 .4 .6 .7 .75 .8 .85 .9 .935 .97 1
-----
NUMAF     (INTEGER)
    NO. AIRFOIL TABLES
ENTER     1 INTEGER VALUE(S)
1
-----
AFTAB1    (AIRFOIL DS)
    NAME AF   TABLE 1
ENTER AIRFOIL DATASET NAME
AFD161
-----
NUMAF1    (INTEGER)
    NO. OF STATIONS AF 1
ENTER     1 INTEGER VALUE(S)
12
-----
STA-AF1   (INTEGER)
    STATIONS FOR AF 1
NULL VECTOR (Y OR N)
N
                                                              MORE...
```

```
ENTER   12 INTEGER VALUE(S)
1 2 3 4 5 6 7 8 9 10 11 12
-----
XACC      (REAL)
    A/C OFFSET FROM E.C.
    +FWD (PERCENT OF CHORD)
NULL VECTOR (Y OR N)
Y
-----
CHORDC    (REAL)
  . CHORD (IN)
NULL VECTOR (Y OR N)
N
ENTER 12 REAL VALUE(S)
?
28.5 28.5 28.5 28.5 28.5 28.5 28.5 28.5 28.5 28.5 28.5 28.5
-----
NX        (INTEGER)
    NO. AERO FACTOR STAS
ENTER    1 INTEGER VALUE(S)
2
-----
                                                                  MORE...
XF        (REAL)
    NONDIM FACTOR STAS
ENTER  2 REAL VALUE(S)
?
0 1
-----
FL        (REAL)
    FACTORS FOR CL
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
1 1
-----
FD        (REAL)
    FACTORS FOR CD
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
1 1
-----
                                                                  MORE...
```

```
FM        (REAL)
    FACTORS FOR CM
NULL VECTOR (Y OR N)
N
ENTER  2 REAL VALUE(S)
?
1 1
**********************************************************************
INPUT FOR FORCE FRA3. ROTOR AERO GENERAL

  1 IEQS       - AERODYNAMICS BY EQS =          NO
  2 INFTAB     - INDUCED VEL BY TABLE=          NO
  3 IUNSTD     - UNSTEADY AERO       =          NO
  4 VAIRH      - (REAL) WIND VELOCITY
               0.00000E+00  0.00000E+00  0.00000E+00
  5 ASTALL     - STALL ANGLE (DEG)    =  2.00000E+01
  6 RFCT       - INDUCED VEL FACTOR   =  1.65000E+00
  7 TIPLOC     - TIP LOSS COEFFICIENT=  9.50000E-01
  8 XH         - HUB EXTENT (IN)      =  3.96000E+00
  9 ALT        - VEHICLE HEIGHT (FT) =  2.00000E+02
 10 K27        - TIP VORTEX COEFF     =  0.00000E+00
 11 CD0        - BLADE DRAG COEFFAT   =  6.80000E-03
                                                          MORE...
 12 Q1C        - Q1C COEFFICIENT      =  1.00000E+00
 13 Q2C        - Q2C COEFFICIENT      =  5.00000E-01
 14 ALAMDA     - NONDIM INDUCED VEL   = -1.20000E-02
 15 NXA        - NO. OF STATIONS      =            12
 16 XAERO      - (REAL) NONDIM AERO STATIONS
               1.77000E-01  2.25000E-01  4.00000E-01  6.00000E-01
               7.00000E-01  7.50000E-01  8.00000E-01  8.50000E-01
               9.00000E-01  9.35000E-01  9.70000E-01  1.00000E+00
 17 NUMAF      - NO. AIRFOIL TABLES   =             1
 18 AFTAB1     - NAME AF    TABLE 1   = AFD161  /AIRFOIL
 19 NUMAF1     - NO. OF STATIONS AF 1=            12
 20 STA-AF1    - STATIONS FOR AF 1
                     1          2          3          4          5
                     6          7          8          9         10
                    11         12
 21 XACC       - (REAL) A/C OFFSET FROM E.C.
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 22 CHORDC     - (REAL) CHORD (IN)
               2.85000E+01  2.85000E+01  2.85000E+01  2.85000E+01
               2.85000E+01  2.85000E+01  2.85000E+01  2.85000E+01
                                                          MORE...
```

```
              2.85000E+01  2.85000E+01  2.85000E+01  2.85000E+01
 23 NX        - NO. AERO FACTOR STAS=            2
 24 XF        - NONDIM FACTOR STAS  =  0.00000E+00  1.00000E+00
 25 FL        - FACTORS FOR CL      =  1.00000E+00  1.00000E+00
 26 FD        - FACTORS FOR CD      =  1.00000E+00  1.00000E+00
 27 FM        - FACTORS FOR CM      =  1.00000E+00  1.00000E+00
************************************************************************

RE-ENTER (Y OR N)
N
DATA SET FCT1.65  FOR FRA3 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
```

2.3.5 FFAØ - Fuselage Aerodynamics, Flat Plate Drag.

2.3.5.1 FFAØ User Notes - FFAØ may be used with either CFM2 or CFM3. Wind direction is limited to the vertical plane through the fuselage longitudinal axis. Note: When an aerodynamics data set is used in conjunction with a trim solution (STR3), the wind velocity in the data set must be set to zero.

2.3.5.2 FFAØ Sample Input -

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
FFA0
DATA SET
PLATE
SAVE FILE(R,U1,...)
U1

FORCE FFA0 . FUSELAGE AERO PLATE DRAG

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
FUSELAGE FLAT PLATE DRAG
-----
VAIR      (REAL)
    WIND SPEED
    (FT/SEC)
ENTER 1 REAL VALUE
?
                                                              MORE...
20
-----
CD        (REAL)
    TOTAL DRAG COEFF
ENTER 1 REAL VALUE
?
16.5
-----
YANGL     (REAL)
    WND AXS-REF DOF ANGL
ENTER 1 REAL VALUE
?
30
*************************************************************************
INPUT FOR FORCE FFA0. FUSELAGE AERO PLATE DRAG

  1 VAIR       - WIND SPEED            =  2.00000E+01
  2 CD         - TOTAL DRAG COEFF      =  1.65000E+01
  3 YANGL      - WND AXS-REF DOF ANGL=  3.00000E+01
*************************************************************************

RE-ENTER (Y OR N)
                                                              MORE...
N
DATA SET PLATE    FOR FFA0 SAVED ON U1
COMPONENT, FORCE, OR N
N
```

2.3.6 FFC2 - Fuselage Aerodynamics, Linear (2-d).

2.3.6.1 FFC2 User Notes - FFC2 may be used with either CFM2 or CFM3. The aerodynamic forces and moments are resolved at the fuselage CG, but do not include any modal forces (forces are applied to rigid body degrees of freedom only). Note: When an aerodynamic data set is used in conjunction with a trim solution (STR3), the wind velocity in the data set must be set to zero.

2.3.6.2 FFC2 Sample Input - Input is shown for the FFC2 data set used in the helicopter simulation presented in Section 6 of the User's Manual (AH1G16.5/FFC2). Aerodynamic coefficients have been input for the fuselage, wing, horizontal stabilizer, and vertical stabilizer. Tail rotor thrust has not been included.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
FFC2
DATA SET
AH1G16.5
SAVE FILE(R,U1,...)
U1


FORCE FFC2 . FUSELAGE AERO LINEAR

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
AH1G, 16.5 SQ FT FLAT PLATE DRAG
------
VAIR      (REAL)
     WIND VELOCITY
     VX,VY,VZ (FT/SEC) W.R.T. BODY SYSTEM
NULL VECTOR (Y OR N)
Y
                                                                       MORE...
------
IFUSE     (Y OR N)
     FUSELAGE AERO FORCES
ENTER 1 Y OR N VALUE
Y
------
RFUSE     (REAL)
     FUSELAGE A/C LOC
     RX,RY,RZ IN TERMS OF X,Y,Z COORDINATE SYSTEM(IN)
NULL VECTOR (Y OR N)
N
ENTER  3 REAL VALUE(S)
?
-.68 0 14.925
------
AFUSE     (REAL)
     FUSELAGE AREA
     (SQR FT)
ENTER 1 REAL VALUE
?
1
------
                                                                       MORE...
```

```
AL0FUS    (REAL)
    FUSLAG LIFT COEFF C0
ENTER 1 REAL VALUE
?
0
-----
AL1FUS    (REAL)
    FUSLAG LIFT COEFF C1
    (1/DEG)
ENTER 1 REAL VALUE
?
.32
-----
AL2FUS    (REAL)
    FUSLAG LIFT COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
.0025
-----
CD0FUS    (REAL)
    FUSLAG DRAG COEFF C0
                                                              MORE...
ENTER 1 REAL VALUE
?
16.5
-----
CD1FUS    (REAL)
    FUSLAG DRAG COEFF C1
    (1/DEG)
ENTER 1 REAL VALUE
?
.032
-----
CD2FUS    (REAL)
    FUSLAG DRAG COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
.01
-----
CM0FUS    (REAL)
    FUSELAG MOM COEFF C0
ENTER 1 REAL VALUE
?
                                                              MORE...
```

```
-324
-----
CM1FUS    (REAL)
    FUSELAG MOM COEFF C1
    (1/DEG)
ENTER 1 REAL VALUE
?
48
-----
CM2FUS    (REAL)
    FUSELAG MOM COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
-.12
-----
FUINCI    (REAL)
    FUSELAGE INCIDENCE
    (DEG)
ENTER 1 REAL VALUE
?
0
                                                            MORE...
-----
FUDO      (REAL)
    FUSLAG DOWNWASH ANGL
    (DEG)
ENTER 1 REAL VALUE
?
0
-----
FURATI    (REAL)
    FUSLAG VELOCTY RATIO
    (LOCAL STREAM VEL/FREE STREAM VEL)**2
ENTER 1 REAL VALUE
?
1
-----
IWING     (Y OR N)
    CONSIDER WING
ENTER 1 Y OR N VALUE
Y
-----
RWING     (REAL)
    WING A/C LOC
                                                            MORE...
```

```
    RX,RY,RZ IN TERMS OF X,Y,Z COORDINATE SYSTEM(IN)
NULL VECTOR (Y OR N)
N.
ENTER  3 REAL VALUE(S)
?
-10.95 0 12.005
-----
AWING    (REAL)
    WING AREA (SQR FT)
ENTER 1 REAL VALUE
?
28.15
-----
AL0WIN   (REAL)
    WING LIFT COEFF C0
ENTER 1 REAL VALUE
?
.58
-----
AL1WIN   (REAL)
    WING LIFT COEFF C1
    (1/DEG)
                                                      MORE...
ENTER 1 REAL VALUE
?
.06
-----
AL2WIN   (REAL)
    WING LIFT COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
-.007
-----
CD0WIN   (REAL)
    WING DRAG COEFF C0
ENTER 1 REAL VALUE
?
.064
-----
CD1WIN   (REAL)
    WING DRAG COEFF C1
    (1/DEG)
ENTER 1 REAL VALUE
?
                                                      MORE...
```

```
0
-----
CD2WIN   (REAL)
    WING DRAG COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
0
-----
CM0WIN   (REAL)
    WING MOM COEFF C0
ENTER 1 REAL VALUE
?
-1
-----
CM1WIN   (REAL)
    WING MOM COEFF C1
    (1/DEG)
ENTER 1 REAL VALUE
?
0
-----
                                                  MORE...
CM2WIN   (REAL)
    WING MOM COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
0
-----
WINCI    (REAL)
    WING INCIDENCE (DEG)
ENTER 1 REAL VALUE
?
4.8
-----
WINGDO   (REAL)
    WING DOWNWASH ANGLE
    (DEG)
ENTER 1 REAL VALUE
?
0
-----
WRATI    (REAL)
    WING VELOCITY RATIO
                                                  MORE...
```

```
    (LOCAL STREAM VEL/FREE STREAM VEL)**2
ENTER 1 REAL VALUE
?
1
-----
IHT       (Y OR N)
    CONSIDER HORIZ TAIL
ENTER 1 Y OR N VALUE
Y
-----
RHT       (REAL)
    HTAIL A/C LOC
    RX,RY,RZ IN TERMS OF X,Y,Z COORDINATE SYSTEM(IN)
NULL VECTOR (Y OR N)
N
ENTER  3 REAL VALUE(S)
?
196.82 0 -40.8
-----
AHT       (REAL)
    HORIZONTAL TAIL AREA
    (SQR FT)
                                                                    MORE...
ENTER 1 REAL VALUE
?
15.2
-----
AL0HT     (REAL)
    HTAIL LIFT COEFF C0
ENTER 1 REAL VALUE
?
-.25
-----
AL1HT     (REAL)
    HTAIL LIFT COEFF C1
    (1/DEG)
ENTER 1 REAL VALUE
?
.00755
-----
AL2HT     (REAL)
    HTAIL LIFT COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
                                                                    MORE...
```

```
.00152
-----
CD0HT     (REAL)
    HTAIL DRAG COEFF C0
ENTER 1 REAL VALUE
?
.025
-----
CD1HT     (REAL)
    HTAIL DRAG COEFF C1
    (1/DEG)
ENTER 1 REAL VALUE
?
0
-----
CD2HT     (REAL)
    HTAIL DRAG COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
0
-----
                                                            MORE...
CM0HT     (REAL)
    HTAIL MOM COEFF C0
ENTER 1 REAL VALUE
?
0
-----
CM1HT     (REAL)
    HTAIL MOM COEFF C1
    (1/DEG)
ENTER 1 REAL VALUE
?
0
-----
CM2HT     (REAL)
    HTAIL MOM COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
0
-----
HTINCI    (REAL)
    HTAIL INCIDENCE
                                                            MORE...
```

```
    (DEG)
ENTER 1 REAL VALUE
?
6.87
-----
HTDO      (REAL)
    HTAIL DOWNWASH ANGLE\
    (DEG)
ENTER 1 REAL VALUE
?
0
-----
HTRATI    (REAL)
    HTAIL VELOCITY RATIO
    (LOCAL STREAM VEL/FREE STREAM VEL)**2
ENTER 1 REAL VALUE
?
1
-----
IVT       (Y OR N)
    CONSIDER VERT TAIL
ENTER 1 Y OR N VALUE
                                                                  MORE...
Y
-----
RVT       (REAL)
    VTAIL A/C LOC
    RX,RY,RZ IN TERMS OF X,Y,Z COORDINATE SYSTEM(IN)
NULL VECTOR (Y OR N)
N
ENTER  3 REAL VALUE(S)
?
300.32 0 .7
-----
AVT       (REAL)
    VERTICAL TAIL AREA
    (SQR FT)
ENTER 1 REAL VALUE
?
18.87
-----
ALOVT     (REAL)
    VTAIL LIFT COEFF C0
ENTER 1 REAL VALUE
?
                                                                  MORE...
```

```
.22
-----
AL1VT     (REAL)
    VTAIL LIFT COEFF C1
    (1/DEG)
ENTER 1 REAL VALUE
?
0
-----
AL2VT     (REAL)
    VTAIL LIFT COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
0
-----
CD0VT     (REAL)
    VTAIL DRAG COEFF C0
ENTER 1 REAL VALUE
?
.05
-----
                                                                    MORE...
CD1VT     (REAL)
    VTAIL DRAG COEFF C1
    (1/DEG)
ENTER 1 REAL VALUE
?
0
-----
CD2VT     (REAL)
    VTAIL DRAG COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
0
-----
CM0VT     (REAL)
    VTAIL MOM COEFF C0
ENTER 1 REAL VALUE
?
0
-----
CM1VT     (REAL)
    VTAIL MOM COEFF C1
                                                                    MORE...
```

```
    (1/DEG)
ENTER 1 REAL VALUE
?
0
-----
CM2VT     (REAL)
    VTAIL MOM COEFF C2
    (1/DEG/DEG)
ENTER 1 REAL VALUE
?
0
-----
VTINCI    (REAL)
    VTAIL INCIDENCE
    (DEG)
ENTER 1 REAL VALUE
?
4.5
-----
VTDO      (REAL)
    VTAIL DOWNWASH ANGLE
    (DEG)
                                                            MORE...
ENTER 1 REAL VALUE
?
0
-----
VTRATI    (REAL)
    VTAIL VELOCITY RATIO
    (LOCAL STREAM VEL/FREE STREAM VEL)**2
ENTER 1 REAL VALUE
?
1
-----
ITAIL     (Y OR N)
    CONSIDER TAIL ROTOR
ENTER 1 Y OR N VALUE
N
-----
IPROP     (Y OR N)
    CONSIDER PROPELLER
ENTER 1 Y OR N VALUE
N
*************************************************************************
INPUT FOR FORCE FFC2. FUSELAGE AERO LINEAR
                                                            MORE...
```

```
 1 VAIR      - (REAL) WIND VELOCITY
             0.00000E+00  0.00000E+00  0.00000E+00
 2 IFUSE     - FUSELAGE AERO FORCES=           YES
 3 RFUSE     - (REAL) FUSELAGE A/C LOC
            -6.80000E-01  0.00000E+00  1.49250E+01
 4 AFUSE     - FUSELAGE AREA       =  1.00000E+00
 5 AL0FUS    - FUSLAG LIFT COEFF C0=  0.00000E+00
 6 AL1FUS    - FUSLAG LIFT COEFF C1=  3.20000E-01
 7 AL2FUS    - FUSLAG LIFT COEFF C2=  2.50000E-03
 8 CD0FUS    - FUSLAG DRAG COEFF C0=  1.65000E+01
 9 CD1FUS    - FUSLAG DRAG COEFF C1=  3.20000E-02
10 CD2FUS    - FUSLAG DRAG COEFF C2=  1.00000E-02
11 CM0FUS    - FUSELAG MOM COEFF C0= -3.24000E+02
12 CM1FUS    - FUSELAG MOM COEFF C1=  4.80000E+01
13 CM2FUS    - FUSELAG MOM COEFF C2= -1.20000E-01
14 FUINCI    - FUSELAGE INCIDENCE  =  0.00000E+00
15 FUDO      - FUSLAG DOWNWASH ANGL=  0.00000E+00
16 FURATI    - FUSLAG VELOCTY RATIO=  1.00000E+00
17 IWING     - CONSIDER WING       =           YES
18 RWING     - (REAL) WING A/C LOC
            -1.09500E+01  0.00000E+00  1.20050E+01
                                                           MORE...
19 AWING     - WING AREA (SQR FT)  =  2.81500E+01
20 AL0WIN    - WING LIFT COEFF C0  =  5.80000E-01
21 AL1WIN    - WING LIFT COEFF C1  =  6.00000E-02
22 AL2WIN    - WING LIFT COEFF C2  = -7.00000E-03
23 CD0WIN    - WING DRAG COEFF C0  =  6.40000E-02
24 CD1WIN    - WING DRAG COEFF C1  =  0.00000E+00
25 CD2WIN    - WING DRAG COEFF C2  =  0.00000E+00
26 CM0WIN    - WING MOM COEFF C0   = -1.00000E+00
27 CM1WIN    - WING MOM COEFF C1   =  0.00000E+00
28 CM2WIN    - WING MOM COEFF C2   =  0.00000E+00
29 WINCI     - WING INCIDENCE (DEG)=  4.80000E+00
30 WINGDO    - WING DOWNWASH ANGLE =  0.00000E+00
31 WRATI     - WING VELOCITY RATIO =  1.00000E+00
32 IHT       - CONSIDER HORIZ TAIL =           YES
33 RHT       - (REAL) HTAIL A/C LOC
             1.96820E+02  0.00000E+00 -4.08000E+01
34 AHT       - HORIZONTAL TAIL AREA=  1.52000E+01
35 AL0HT     - HTAIL LIFT COEFF C0 = -2.50000E-01
36 AL1HT     - HTAIL LIFT COEFF C1 =  7.55000E-03
37 AL2HT     - HTAIL LIFT COEFF C2 =  1.52000E-03
38 CD0HT     - HTAIL DRAG COEFF C0 =  2.50000E-02
39 CD1HT     - HTAIL DRAG COEFF C1 =  0.00000E+00
                                                           MORE...
```

```
 40 CD2HT    - HTAIL DRAG COEFF C2 =  0.00000E+00
 41 CM0HT    - HTAIL MOM COEFF C0  =  0.00000E+00
 42 CM1HT    - HTAIL MOM COEFF C1  =  0.00000E+00
 43 CM2HT    - HTAIL MOM COEFF C2  =  0.00000E+00
 44 HTINCI   - HTAIL INCIDENCE     =  6.87000E+00
 45 HTDO     - HTAIL DOWNWASH ANGLE=  0.00000E+00
 46 HTRATI   - HTAIL VELOCITY RATIO=  1.00000E+00
 47 IVT      - CONSIDER VERT TAIL  =        YES
 48 RVT      - (REAL) VTAIL A/C LOC
           3.00320E+02  0.00000E+00  7.00000E-01
 49 AVT      - VERTICAL TAIL AREA  =  1.88700E+01
 50 AL0VT    - VTAIL LIFT COEFF C0 =  2.20000E-01
 51 AL1VT    - VTAIL LIFT COEFF C1 =  0.00000E+00
 52 AL2VT    - VTAIL LIFT COEFF C2 =  0.00000E+00
 53 CD0VT    - VTAIL DRAG COEFF C0 =  5.00000E-02
 54 CD1VT    - VTAIL DRAG COEFF C1 =  0.00000E+00
 55 CD2VT    - VTAIL DRAG COEFF C2 =  0.00000E+00
 56 CM0VT    - VTAIL MOM COEFF C0  =  0.00000E+00
 57 CM1VT    - VTAIL MOM COEFF C1  =  0.00000E+00
 58 CM2VT    - VTAIL MOM COEFF C2  =  0.00000E+00
 59 VTINCI   - VTAIL INCIDENCE     =  4.50000E+00
 60 VTDO     - VTAIL DOWNWASH ANGLE=  0.00000E+00
                                                        MORE...
 61 VTRATI   - VTAIL VELOCITY RATIO=  1.00000E+00
 62 ITAIL    - CONSIDER TAIL ROTOR =        NO
 63 IPROP    - CONSIDER PROPELLER  =        NO
***********************************************************************

RE-ENTER (Y OR N)
N
DATA SET AH1G16.5 FOR FFC2 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
                                                        VM READ
```

2.3.7 FLA2 - Lifting Surface Aerodynamics.

2.3.7.1 FLA2 User Notes - FLA2 is used exclusively with CLS2. The aerodynamic forces and moments are resolved at the wing attachment point, but do not include modal forces (forces are applied to rigid body degrees of freedom only). However, the computed section angles of attack include the modal displacements. Application of this algorithm is limited to representing conditions that do not include flow separation and shock waves and do not violate the limits of linearity used in small perturbation analysis.

2.3.7.2 FLA2 Sample Input - Input is shown for a swept and tapered vertical stabilizer. A rudder has been defined and extends from the root to 80% of the span.

```
NEW
NEW MODEL (Y OR N)
N
COMPONENT, FORCE, OR N
FLA2
DATA SET
FIN
SAVE FILE(R,U1,...)
U1

FORCE FLA2 . LIFTING SURFACE AERO

BEGIN INPUT
DESCRIPTION (UP TO 71 CHARACTERS)
VERTICAL STABILIZER
-----
NWNG      (INTEGER)
    NO. OF SEMI-SPANS
ENTER     1 INTEGER VALUE(S)
1
-----
                                                             MORE...
B2        (REAL)
    LENGTH OF SEMI-SPAN
    (IN)
ENTER 1 REAL VALUE
?
150
-----
S         (REAL)
    PLANFORM AREA
    (IN**2)
ENTER 1 REAL VALUE
?
8000
-----
TR        (REAL)
    TAPER RATIO
    (TIP CHORD/ROOT CHORD)
ENTER 1 REAL VALUE
?
.2
-----
QMACH     (REAL)
                                                             MORE...
```

```
    FREESTREAM MACH NO.
ENTER 1 REAL VALUE
?
.3
-----
QLAM      (REAL)
    LEADING EDGE SWEEP
    (DEGREES)
ENTER 1 REAL VALUE
?
30
-----
ICS       (Y OR N)
    CONTROL SURFACE
ENTER 1 Y OR N VALUE
Y
-----
YCSO      (REAL)
    SPANWISE LOCATION
    CONTROL SURFACE OUTBD EDGE (PERCENT SEMI-SPAN)
ENTER 1 REAL VALUE
?
                                                            MORE...
80
-----
CLA8      (REAL)
    LIFT CURVE SLOPE
    (PER RAD)
NULL VECTOR (Y OR N)
N
ENTER  8 REAL VALUE(S)
?
.1 .1 .1 .1 .1 .1 .1 .1
-----
A08       (REAL)
    0 LIFT ANGLE
    (DEG)
NULL VECTOR (Y OR N)
Y
-----
CMA8      (REAL)
    MOMENT CURVE SLOPE
    (PER RAD)
NULL VECTOR (Y OR N)
N
                                                            MORE...
```

```
ENTER  8 REAL VALUE(S)
?
.001 .001 .001 .001 .001 .001 .001 .001
-----
CM08      (REAL)
    0 LIFT MOMENT COEFF
NULL VECTOR (Y OR N)
Y
-----
CLD       (REAL)
    C S LIFT CURVE
    SLOPE (PER RAD)
ENTER 1 REAL VALUE
?
.1
-----
CMD       (REAL)
    C S MOMENT CURVE
    SLOPE (PER RAD)
ENTER 1 REAL VALUE
?
.001
                                                                   MORE...
-----
PA        (REAL)
    AMBIENT PRESSURE
    (PSI)
ENTER 1 REAL VALUE
?
14.7
**********************************************************************
INPUT FOR FORCE FLA2. LIFTING SURFACE AERO

  1 NWNG       - NO. OF SEMI-SPANS    =            1
  2 B2         - LENGTH OF SEMI-SPAN =  1.50000E+02
  3 S          - PLANFORM AREA        =  8.00000E+03
  4 TR         - TAPER RATIO          =  2.00000E-01
  5 QMACH      - FREESTREAM MACH NO. =  3.00000E-01
  6 QLAM       - LEADING EDGE SWEEP   =  3.00000E+01
  7 ICS        - CONTROL SURFACE      =          YES
  8 YCSO       - SPANWISE LOCATION    =  8.00000E+01
  9 CLA8       - (REAL) LIFT CURVE SLOPE
                1.00000E-01  1.00000E-01  1.00000E-01  1.00000E-01
                1.00000E-01  1.00000E-01  1.00000E-01  1.00000E-01
 10 A08        - (REAL) 0 LIFT ANGLE
                                                                   MORE...
```

```
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 11 CMA8      - (REAL) MOMENT CURVE SLOPE
              1.00000E-03  1.00000E-03  1.00000E-03  1.00000E-03
              1.00000E-03  1.00000E-03  1.00000E-03  1.00000E-03
 12 CM08      - (REAL) 0 LIFT MOMENT COEFF
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 13 CLD       - C S LIFT CURVE      =  1.00000E-01
 14 CMD       - C S MOMENT CURVE    =  1.00000E-03
 15 PA        - AMBIENT PRESSURE    =  1.47000E+01
******************************************************************

RE-ENTER (Y OR N)
N
DATA SET FIN      FOR FLA2 SAVED ON U1
COMPONENT, FORCE, OR N
N
COMMAND
```

2.4 SOLUTIONS

Solution data is input during a RUN sequence. In the examples which follow, the RUN command has been used to demonstrate solution features. The user should refer directly to paragraph 3.3 of the DYSCO 4.1 User's Manual while reviewing the sample dialogues.

2.4.1 SEA3 - Eigenanalysis. A solution for the spring-mass-damper system shown in Figure 11 is performed. Note that damping is ignored. The model details and the constant coupled system matrices are also printed out.

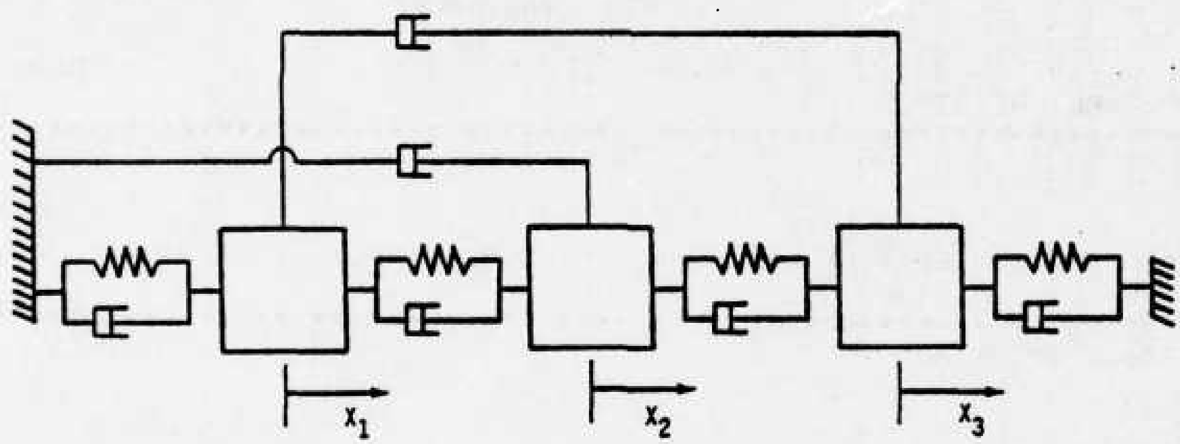

Figure 11. Spring-Mass-Damper System.

```
RUN
MODEL NAME (DATA SET)
AD
LIST MODEL SUMMARY (Y OR N)
Y

***********************        MODEL AD        **********************

SMD SYSTEM WITH ADDITIONAL DAMPERS

INDEX    COMP    NO.    DATA SET      FORCE    DATA SET

  1      CSF1           SMD           NONE.
  2      CSF1           C5            NONE
  3      CSF1           C6            NONE

*******************************************************************

*******************************************************************
                         GLOBAL  VARIABLES

                                                        MORE...
 NO INPUT REQUIRED
*******************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
******************************************************************
DETAILS (Y OR N)
Y


 ******************************************************************
                    COMPONENT DOF/SYSTEM DOF
             1, 6          2, 7          3, 8         4, 9         5, 10


  1  CSF1    X      0     Y      0     Z      0
             (    1)      (    2)      (    3)

  2  CSF1    X      0     Z      0
             (    1)      (    3)
                                                        MORE...
```

```
  3  CSF1     Y       0
                (    2)


          SYSTEM DOF

          1     X       0
          2     Y       0
          3     Z       0
PRINT MATRICES (Y OR N)
Y
MASS (Y OR N)
Y
            GENERAL MATRIX

    ROW     1
           1.00000E+00  0.00000E+00  0.00000E+00
    ROW     2
           0.00000E+00  2.00000E+00  0.00000E+00
    ROW     3
           0.00000E+00  0.00000E+00  3.00000E+00
                                                           MORE...
DAMPING (Y OR N)
Y
            GENERAL MATRIX

    ROW     1
           8.00000E+00 -2.00000E+00 -5.00000E+00
    ROW     2
          -2.00000E+00  1.10000E+01 -3.00000E+00
    ROW     3
          -5.00000E+00 -3.00000E+00  1.20000E+01
STIFFNESS (Y OR N)
Y
            GENERAL MATRIX

    ROW     1
           3.00000E+01 -2.00000E+01  0.00000E+00
    ROW     2
          -2.00000E+01  5.00000E+01 -3.00000E+01
    ROW     3
           0.00000E+00 -3.00000E+01  7.00000E+01
FORCE (Y OR N)
Y
                                                           MORE...
```

```
         0.00000E+00  0.00000E+00  0.00000E+00
*******************************************************************
SOLUTION OR N
SEA3
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION SEA3. EIGEN ANALYSIS

BEGIN INPUT
-----
NMODES   (INTEGER)
    NO. OF MODES
ENTER    1 INTEGER VALUE(S)
3
-----
ITMAX    (INTEGER)
    MAX NO. OF ITERATNS
ENTER    1 INTEGER VALUE(S)
1000
-----
                                                             MORE...
TOL      (REAL)
    RATIO TOLERANCE
    EIGENVALUE
ENTER 1 REAL VALUE
?
.0001
-----
TOLM     (REAL)
    RATIO TOLERANCE
    EIGENVECTOR
ENTER 1 REAL VALUE
?
.0001
*******************************************************************
SOLUTION INPUT FOR SEA3.EIGEN ANALYSIS

  1 NMODES   - NO. OF MODES        =          3
  2 ITMAX    - MAX NO. OF ITERATNS =       1000
  3 TOL      - RATIO TOLERANCE     =  1.00000E-04
  4 TOLM     - RATIO TOLERANCE     =  1.00000E-04
*******************************************************************

                                                             MORE...
```

```
RE-ENTER (Y OR N)
N

***************** SOLUTION SEA3 FOR MODEL AD        *****************
MODEL    - SMD SYSTEM WITH ADDITIONAL DAMPERS
SOLUTION - EIGEN ANALYSIS


MODE            1            2            3

FREQ  HZ   4.2294E-01   8.1391E-01   1.0690E+00
   RAD/S   2.6574E+00   5.1139E+00   6.7169E+00

GEN MASS   3.8935E+00   2.4674E+00   2.5019E+00
NO ITERS       25           43           13

SYS DOF

X      0     0.8719       1.0000       1.0000
Y      0     1.0000       0.1925      -0.7555
                                                           MORE...
Z      0     0.6146      -0.6814       0.3466
**********************************************************************
COMMAND
```

2.4.2 SEA4 - Eigenanalysis. A solution for the spring-mass-damper system shown in Figure 11 is performed. Note that damping is ignored.

```
RUN
MODEL NAME (DATA SET)
AD
LIST MODEL SUMMARY (Y OR N)
Y

************************      MODEL AD       ********************

SMD SYSTEM WITH ADDITIONAL DAMPERS

INDEX   COMP   NO.  DATA SET       FORCE  DATA SET

  1     CSF1        SMD            NONE
  2     CSF1        C5             NONE
  3     CSF1        C6             NONE

*****************************************************************

*****************************************************************
                        GLOBAL  VARIABLES

                                                         MORE...
 NO INPUT REQUIRED
*****************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
*****************************************************************
DETAILS (Y OR N)
N
PRINT MATRICES (Y OR N)
N
*****************************************************************
SOLUTION OR N
SEA4
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION SEA4. EIGEN ANALYSIS

BEGIN INPUT
                                                         MORE...
```

```
-----
NMODES    (INTEGER)
    NUMBER OF MODES
ENTER     1 INTEGER VALUE(S)
3
**********************************************************************
SOLUTION INPUT FOR SEA4.EIGEN ANALYSIS

  1 NMODES    - NUMBER OF MODES     =             3
**********************************************************************

RE-ENTER (Y OR N)
N

***************** SOLUTION SEA4 FOR MODEL AD       *****************
MODEL     - SMD SYSTEM WITH ADDITIONAL DAMPERS
SOLUTION  - EIGEN ANALYSIS


MODE            1            2            3
                                                                MORE...

FREQ  HZ  4.2295E-01  8.1395E-01  1.0690E+00
   RAD/S  2.6575E+00  5.1142E+00  6.7169E+00

GEN MASS  3.8934E+00  2.4671E+00  2.5037E+00

SYS DOF

X      0      0.8719      1.0000      1.0000
Y      0      1.0000      0.1923     -0.7558
Z      0      0.6146     -0.6815      0.3470
THE PERFORMANCE INDEX IS     0.004278
*** THE EIGEN-ANALYSIS HAS BEEN PERFORMED WELL (SATISFACTORILY, POORLY)
IF P IS LESS THAN 1 (BETWEEN 1 AND 100, GREATER THAN 100).
*********************************************************************
COMMAND
```

2.4.3 SEA5 - Eigenanalysis. Two solutions are performed for the spring-mass-damper system shown in Figure 11. Damping has been ignored in the first example and included in the second example. The eigenvectors for different combinations of system and component degrees of freedom have been selected for output in the two examples. Note that the degrees of freedom for which output has been selected must be unique. A component degree of freedom included in more than one data set may only be selected once. Once selected, it is eliminated from the list of remaining degrees of freedom as shown in the second example.

```
RUN
MODEL NAME (DATA SET)
AD
LIST MODEL SUMMARY (Y OR N)
Y

***********************          MODEL AD          *******************

SMD SYSTEM WITH ADDITIONAL DAMPERS

INDEX    COMP    NO.    DATA SET        FORCE    DATA SET

  1      CSF1           SMD             NONE
  2      CSF1           C5              NONE
  3      CSF1           C6              NONE

*******************************************************************

*******************************************************************
                          GLOBAL  VARIABLES

                                                           MORE...
 NO INPUT REQUIRED
*******************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
*******************************************************************
DETAILS (Y OR N)
N
PRINT MATRICES (Y OR N)
N
*******************************************************************
SOLUTION OR N
SEA5
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION SEA5. GENERAL EIGEN ANALYSIS

BEGIN INPUT

                                                           MORE...
```

```
-----
NMODES   (INTEGER)
    NUMBER OF MODES
ENTER     1 INTEGER VALUE(S)
6
-----
IDAMP    (Y OR N)
    CONSIDER DAMPING
    MATRIX - YES OR NO?
ENTER 1 Y OR N VALUE
N
-----
DOFPRINT (MODEL DOFS CHOSEN )
    DOFS TO BE PRINTED
SYSTEM DOFS
    1 X       0      2 Y       0      3 Z       0

ALL SYSTEM DOFS (Y OR N)
N
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
1 3 0
                                                                   MORE...
ANY COMPONENT DOFS (Y OR N)
Y

SET OF COMPONENTS
   1 SMD       /CSF1
   2 C5        /CSF1
   3 C6        /CSF1
SELECT COMPONENTS BY INDICES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
3 0
DOFS FOR COMPONENT C6       /CSF1
    1 Y       0

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
1 0
***********************************************************************
SOLUTION INPUT FOR SEA5.GENERAL EIGEN ANALYSIS

  1 NMODES    - NUMBER OF MODES      =            6
                                                                   MORE...
```

```
  2 IDAMP     - CONSIDER DAMPING     =          NO
  3 DOFPRINT - (MODEL DOFS SELECTED) DOFS TO BE PRINTED
      SYSTEM DOFS SELECTED
           X        0  Z        0
     COMPONENT C6        /CSF1 DOFS
           Y        0
*********************************************************************

RE-ENTER (Y OR N)
N

***************** SOLUTION SEA5 FOR MODEL AD        *****************
MODEL     - SMD SYSTEM WITH ADDITIONAL DAMPERS
SOLUTION  - GENERAL EIGEN ANALYSIS


OUTPUT MODES


MODE    1           FREQUENCY (HZ)            DAMPING
                                                            MORE...
                     1.0690E+00                2.3756E-06

                    COMPLEX EIGENVECTOR
                    (NORMALIZED TO LARGEST COMPONENT)
DOF - VELOCITY      REAL                      IMAGINARY
X       0            1.0000                    0.0000
Z       0            0.3470                    0.0000
Y       0           -0.7558                    0.0000
DOF - DISPLACEMENT
X       0            0.0000                   -0.1489
Z       0            0.0000                   -0.0517
Y       0            0.0000                    0.1125


MODE    2           FREQUENCY (HZ)            DAMPING
                    -1.0690E+00                2.3748E-06

                    COMPLEX EIGENVECTOR
                    (NORMALIZED TO LARGEST COMPONENT)
DOF - VELOCITY      REAL                      IMAGINARY
X       0            1.0000                    0.0000
                                                            MORE...
```

Z	0	0.3470	0.0000
Y	0	-0.7558	0.0000
DOF - DISPLACEMENT			
X	0	0.0000	0.1489
Z	0	0.0000	0.0517
Y	0	0.0000	-0.1125

MODE 3	FREQUENCY (HZ)	DAMPING
	4.2295E-01	-8.3898E-07

COMPLEX EIGENVECTOR
(NORMALIZED TO LARGEST COMPONENT)

DOF - VELOCITY		REAL	IMAGINARY
X	0	0.8719	0.0000
Z	0	0.6146	0.0000
Y	0	1.0000	0.0000
DOF - DISPLACEMENT			
X	0	0.0000	-0.3281
Z	0	0.0000	-0.2313
Y	0	0.0000	-0.3763

MORE...

MODE 4	FREQUENCY (HZ)	DAMPING
	-4.2295E-01	-8.5378E-07

COMPLEX EIGENVECTOR
(NORMALIZED TO LARGEST COMPONENT)

DOF - VELOCITY		REAL	IMAGINARY
X	0	0.8719	0.0000
Z	0	0.6146	0.0000
Y	0	1.0000	0.0000
DOF - DISPLACEMENT			
X	0	0.0000	0.3281
Z	0	0.0000	0.2313
Y	0	0.0000	0.3763

MODE 5	FREQUENCY (HZ)	DAMPING
	8.1395E-01	3.8611E-06

MORE...

COMPLEX EIGENVECTOR
(NORMALIZED TO LARGEST COMPONENT)

DOF - VELOCITY		REAL	IMAGINARY
X	0	1.0000	0.0000
Z	0	-0.6815	0.0000
Y	0	0.1923	0.0000
DOF - DISPLACEMENT			
X	0	0.0000	-0.1955
Z	0	0.0000	0.1333
Y	0	0.0000	-0.0376

MODE	6	FREQUENCY (HZ)	DAMPING
		-8.1394E-01	3.8636E-06

COMPLEX EIGENVECTOR
(NORMALIZED TO LARGEST COMPONENT)

DOF - VELOCITY		REAL	IMAGINARY
X	0	1.0000	0.0000
Z	0	-0.6815	0.0000
Y	0	0.1923	0.0000

MORE...

DOF - DISPLACEMENT			
X	0	0.0000	0.1955
Z	0	0.0000	-0.1333
Y	0	0.0000	0.0376

MODE	FREQUENCY (HZ)	DAMPING
1	1.0690E+00	2.3756E-06
2	-1.0690E+00	2.3748E-06
3	4.2295E-01	-8.3898E-07
4	-4.2295E-01	-8.5378E-07
5	8.1395E-01	3.8611E-06
6	-8.1394E-01	3.8636E-06

****
COMMAND

```
RERUN
RERUNNING MODEL AD
*********************************************************************
DETAILS (Y OR N)
N
PRINT MATRICES (Y OR N)
N
*********************************************************************
SOLUTION OR N
SEA5
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION SEA5. GENERAL EIGEN ANALYSIS

BEGIN INPUT
-----
NMODES   (INTEGER)
    NUMBER OF MODES
ENTER     1 INTEGER VALUE(S)
6
                                                              MORE...
-----
IDAMP     (Y OR N)
     CONSIDER DAMPING
     MATRIX - YES OR NO?
ENTER 1 Y OR N VALUE
Y
-----
DOFPRINT (MODEL DOFS CHOSEN )
     DOFS TO BE PRINTED
SYSTEM DOFS
    1 X      0     2 Y      0     3 Z      0

ALL SYSTEM DOFS (Y OR N)
N
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
0
ANY COMPONENT DOFS (Y OR N)
Y

SET OF COMPONENTS
   1 SMD     /CSF1
                                                              MORE...
```

```
   2 C5       /CSF1
   3 C6       /CSF1
SELECT COMPONENTS BY INDICES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER         0
1 2 3 0
DOFS FOR COMPONENT SMD       /CSF1
    1 X      0     2 Y     0     3 Z     0

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER         0
2 0
DOFS FOR COMPONENT C5        /CSF1
    1 X      0     2 Z     0

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER         0
1 2 0
                                                              MORE...
COMPONENT C6  CSF1 HAS NO UNIQUE DOFS BEYOND THOSE PREVIOUSLY SELECTED
**********************************************************************
SOLUTION INPUT FOR SEA5.GENERAL EIGEN ANALYSIS

  1 NMODES    - NUMBER OF MODES      =             6
  2 IDAMP     - CONSIDER DAMPING     =           YES
  3 DOFPRINT - (MODEL DOFS SELECTED) DOFS TO BE PRINTED
     COMPONENT SMD      /CSF1 DOFS
          Y      0
     COMPONENT C5       /CSF1 DOFS
          X      0  Z      0
**********************************************************************

RE-ENTER (Y OR N)
N

***************** SOLUTION SEA5 FOR MODEL AD       *****************
MODEL    - SMD SYSTEM WITH ADDITIONAL DAMPERS
SOLUTION - GENERAL EIGEN ANALYSIS

                                                              MORE...
```

OUTPUT MODES

MODE 1		FREQUENCY (HZ)	DAMPING
		8.8058E-01	-2.9045E+00

COMPLEX EIGENVECTOR
(NORMALIZED TO LARGEST COMPONENT)

DOF - VELOCITY		REAL	IMAGINARY
Y	0	1.0000	0.0000
X	0	-0.5863	0.0669
Z	0	-0.4555	0.4547
DOF - DISPLACEMENT			
Y	0	-0.0744	-0.1417
X	0	0.0531	0.0781
Z	0	0.0983	0.0307

MODE 2		FREQUENCY (HZ)	DAMPING
		-8.8058E-01	-2.9045E+00

MORE...

COMPLEX EIGENVECTOR
(NORMALIZED TO LARGEST COMPONENT)

DOF - VELOCITY		REAL	IMAGINARY
Y	0	1.0000	0.0000
X	0	-0.5863	-0.0669
Z	0	-0.4555	-0.4547
DOF - DISPLACEMENT			
Y	0	-0.0744	0.1417
X	0	0.0531	-0.0781
Z	0	0.0983	-0.0307

MODE 3		FREQUENCY (HZ)	DAMPING
		4.0332E-01	-1.2299E+00

COMPLEX EIGENVECTOR
(NORMALIZED TO LARGEST COMPONENT)

DOF - VELOCITY		REAL	IMAGINARY
Y	0	1.0000	0.0000
X	0	0.7461	0.0407

MORE...

Z	0	0.5938	0.2432
DOF - DISPLACEMENT			
Y	0	-0.1550	-0.3194
X	0	-0.1026	-0.2446
Z	0	-0.0144	-0.2273

MODE 4 FREQUENCY (HZ) -4.0332E-01 DAMPING -1.2299E+00

COMPLEX EIGENVECTOR
(NORMALIZED TO LARGEST COMPONENT)

DOF - VELOCITY		REAL	IMAGINARY
Y	0	1.0000	0.0000
X	0	0.7461	-0.0407
Z	0	0.5938	-0.2432
DOF - DISPLACEMENT			
Y	0	-0.1550	0.3194
X	0	-0.1026	0.2446
Z	0	-0.0144	0.2273

MORE...

MODE 5 FREQUENCY (HZ) 3.7635E-01 DAMPING -4.6155E+00

COMPLEX EIGENVECTOR
(NORMALIZED TO LARGEST COMPONENT)

DOF - VELOCITY		REAL	IMAGINARY
Y	0	0.0835	0.1213
X	0	1.0000	0.0000
Z	0	-0.3715	0.0095
DOF - DISPLACEMENT			
Y	0	-0.0037	-0.0282
X	0	-0.1716	-0.0879
Z	0	0.0646	0.0310

MODE 6 FREQUENCY (HZ) -3.7635E-01 DAMPING -4.6155E+00

COMPLEX EIGENVECTOR

MORE...

(NORMALIZED TO LARGEST COMPONENT)

DOF - VELOCITY		REAL	IMAGINARY
Y	0	0.0835	-0.1213
X	0	1.0000	0.0000
Z	0	-0.3715	-0.0095
DOF - DISPLACEMENT			
Y	0	-0.0037	0.0282
X	0	-0.1716	0.0879
Z	0	0.0646	-0.0310

MODE	FREQUENCY (HZ)	DAMPING
1	8.8058E-01	-2.9045E+00
2	-8.8058E-01	-2.9045E+00
3	4.0332E-01	-1.2299E+00
4	-4.0332E-01	-1.2299E+00
5	3.7635E-01	-4.6155E+00
6	-3.7635E-01	-4.6155E+00

****

COMMAND

2.4.4 SSF9 - Stability Floquet. A solution is performed for the spring-mass-damper system shown in Figure 11. Since the system is linear and nonperiodic (constant coefficients), an initial integration increment approximately an order of magnitude smaller than the period of the highest undamped frequency of the system has been selected. An error check should always be used unless the characteristics of the system are well known. In general, constant values can be selected for the error allowed and the increment for computing the Floquet transition matrix. Smaller values may be required for systems with more degrees of freedom, repeated roots (this algorithm can accommodate up to four repeated roots), higher frequencies, and wider frequency ranges.

```
RUN
MODEL NAME (DATA SET)
AD
LIST MODEL SUMMARY (Y OR N)
Y


*************************        MODEL AD        *********************

SMD SYSTEM WITH ADDITIONAL DAMPERS

INDEX   COMP   NO.   DATA SET      FORCE   DATA SET

  1     CSF1         SMD           NONE
  2     CSF1         C5            NONE
  3     CSF1         C6            NONE

**********************************************************************

**********************************************************************
                           GLOBAL  VARIABLES

                                                              MORE...
 NO INPUT REQUIRED
**********************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
**********************************************************************
DETAILS (Y OR N)
N
PRINT MATRICES (Y OR N)
N
**********************************************************************
SOLUTION OR N
SSF3
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION SSF3. STABILITY FLOQUET

BEGIN INPUT
                                                              MORE...
```

```
-----
H         (REAL)
    INITIAL INCREMENT
    (SEC)
ENTER 1 REAL VALUE
?
.1
-----
TPER      (REAL)
    INTEGRATION PERIOD
ENTER 1 REAL VALUE
?
.2
-----
HTD       (REAL)
    SEPARATE INCREMENT
    TIME DEP COEFS
ENTER 1 REAL VALUE
?
0
-----
HF        (REAL)
                                                                  MORE...
    SEPARATE INCREMENT
    FORCE COMPUTATION
ENTER 1 REAL VALUE
?
0
-----
E         (REAL)
    ERROR CHECK VALUE
    IF 0 THEN CONSTANT INCREMENT USED
ENTER 1 REAL VALUE
?
.0001
-----
NALLOW    (INTEGER)
    NO. OF ITERATIONS
    ALLOWED
ENTER     1 INTEGER VALUE(S)
10
-----
CEA       (Y OR N)
    CONSTANT ERROR
    ALLOWED, ENTER YES. IF NOT ENTER NO
                                                                  MORE...
```

```
ENTER 1 Y OR N VALUE
Y
-----
CEALLO   (REAL)
    CONSTANT ERROR
    ALLOWED
ENTER 1 REAL VALUE
?
.0001
-----
CI        (Y OR N)
    CONSTANT INCREMENT
    FOR COMPUTING TRANSITION MATRIX, ENTER YES ELSE ENTER NO
ENTER 1 Y OR N VALUE
Y
-----
CICRE    (REAL)
    CONSTANT INCREMENT
    TO BE USED
ENTER 1 REAL VALUE
?
.5
                                                                  MORE...
-----
ICON     (INTEGER)
    ROTOR CONTROLS
    INPUT TYPE  0 = NULL, 1 = GENERAL, 2 = CONTINUE
ENTER    1 INTEGER VALUE(S)
0
-----
IPRINT   (Y OR N)
    PRINT EIGENVECTORS
    YES OR NO
ENTER 1 Y OR N VALUE
Y
*******************************************************************
SOLUTION INPUT FOR SSF3.STABILITY FLOQUET

  1 H        - INITIAL INCREMENT    =  1.00000E-01
  2 TPER     - INTEGRATION PERIOD   =  2.00000E-01
  3 HTD      - SEPARATE INCREMENT   =  0.00000E+00
  4 HF       - SEPARATE INCREMENT   =  0.00000E+00
  5 E        - ERROR CHECK VALUE    =  1.00000E-04
  6 NALLOW   - NO. OF ITERATIONS    =           10
  7 CEA      - CONSTANT ERROR       =          YES
                                                                  MORE...
```

```
 8 CEALLO     - CONSTANT ERROR        =  1.00000E-04
 9 CI         - CONSTANT INCREMENT    =          YES
10 CICRE      - CONSTANT INCREMENT    =  5.00000E-01
11 ICON       - ROTOR CONTROLS        =            0
12 IPRINT     - PRINT EIGENVECTORS    =          YES
*****************************************************************

RE-ENTER (Y OR N)
N

***************** SOLUTION SSF3 FOR MODEL AD       *****************
MODEL     - SMD SYSTEM WITH ADDITIONAL DAMPERS
SOLUTION  - STABILITY FLOQUET



                  FREQUENCY              DAMPING
                  5.53287                -2.90481

SYSTEM DOF        EIGENVECTOR
                                                            MORE...
X      ODOT       -0.5863       0.0669
Y      ODOT        1.0000       0.0000
Z      ODOT       -0.4555       0.4547
X      0           0.0531       0.0781
Y      0          -0.0744      -0.1417
Z      0           0.0983       0.0307


                  FREQUENCY              DAMPING
                  -5.53286               -2.90480

SYSTEM DOF        EIGENVECTOR
X      ODOT       -0.5863      -0.0669
Y      ODOT        1.0000       0.0000
Z      ODOT       -0.4555      -0.4547
X      0           0.0531      -0.0781
Y      0          -0.0744       0.1417
Z      0           0.0983      -0.0307


                                                            MORE...
```

		FREQUENCY		DAMPING
		2.53419		-1.22994

SYSTEM	DOF	EIGENVECTOR	
X	ODOT	0.7461	0.0407
Y	ODOT	1.0000	0.0000
Z	ODOT	0.5938	0.2432
X	O	-0.1026	-0.2446
Y	O	-0.1550	-0.3194
Z	O	-0.0144	-0.2273

		FREQUENCY		DAMPING
		-2.53419		-1.22994

SYSTEM	DOF	EIGENVECTOR	
X	ODOT	0.7461	-0.0407
Y	ODOT	1.0000	0.0000
Z	ODOT	0.5938	-0.2432
X	O	-0.1026	0.2446
Y	O	-0.1550	0.3194
Z	O	-0.0144	0.2273

MORE...

		FREQUENCY		DAMPING
		2.36465		-4.61560

SYSTEM	DOF	EIGENVECTOR	
X	ODOT	1.0000	0.0000
Y	ODOT	0.0835 /	0.1214
Z	ODOT	-0.3716	0.0095
X	O	-0.1716	-0.0879
Y	O	-0.0037	-0.0282
Z	O	0.0646	0.0310

		FREQUENCY		DAMPING
		-2.36465		-4.61560

SYSTEM	DOF	EIGENVECTOR	
X	ODOT	1.0000	0.0000

MORE...

Y	ODOT	0.0835	-0.1214
Z	ODOT	-0.3716	-0.0095
X	O	-0.1716	0.0879
Y	O	-0.0037	0.0282
Z	O	0.0646	-0.0310

FREQUENCY	DAMPING
5.53287	-2.90481
-5.53286	-2.90480
2.53419	-1.22994
-2.53419	-1.22994
2.36465	-4.61560
-2.36465	-4.61560

****

COMMAND

2.4.5 STH3 - Time History. A solution is performed for the helicopter simulation presented in Section 6 of the User's Manual (AH1G-35A/MODEL). A time history of the trimmed system is obtained. The aerodynamics data sets have been edited to include the wind velocity vector for the trim condition, which has been derived from the given fuselage velocity and the calculated fuselage pitch angle from the last iteration of the trim solution. Also, a CSF1 component has been added to account for the forces due to gravity at the hub (blade weight) and the fuselage CG. The gravity vectors are determined by the fuselage pitch angle.

The integration increment has been set equal to a fraction of the rotation period of the rotor determined by using the error check in a preliminary run. An error check should always be used unless the characteristics of the system are well known. The initial conditions for the elastic degrees of freedom and for the rotor control settings of the trimmed system have been input, and the initial conditions for the system (fuselage) rigid body degrees of freedom have been set to zero. Rotor force output has also been elected.

The rotor data set (B2Z1T2/CRE3) has been edited to allow the time history blade moments to be calculated. Storage of the time history system state vectors for every fifth time increment has been elected (see paragraph 2.4.7).

Note that the final solution increment converges because of the difference between the specified end time and the computed increment.

```
LIST
DATA SET
FCT1.65
DATA MEMBER
FRA3
FCT1.65 /FRA3     FOUND ON FOLLOWING MULTIPLES FILES
 R   U1
ENTER CORRECT FILE
R
FCT1.65 /FRA3     ON FILE R

***************        FCT1.65 /FRA3       ***************

GENERAL AERO, INDUCED VEL 1.65

REQUIRES DS/DM AFD161  /AIRFOIL
NO SEQUENTIAL FILES REQUIRED
**************************************************************************
INPUT FOR FORCE FRA3. ROTOR AERO GENERAL
                                                                MORE...
  1 IEQS      - AERODYNAMICS BY EQS =           NO
  2 INFTAB    - INDUCED VEL BY TABLE=           NO
  3 IUNSTD    - UNSTEADY AERO       =           NO
  4 VAIRH     - (REAL) WIND VELOCITY
               1.13987E+02  0.00000E+00 -1.73500E+00
  5 ASTALL    - STALL ANGLE (DEG)   =  2.00000E+01
  6 RFCT      - INDUCED VEL FACTOR  =  1.65000E+00
  7 TIPLOC    - TIP LOSS COEFFICIENT=  9.50000E-01
  8 XH        - HUB EXTENT (IN)     =  3.96000E+00
  9 ALT       - VEHICLE HEIGHT (FT) =  2.00000E+02
 10 K27       - TIP VORTEX COEFF    =  0.00000E+00
 11 CD0       - BLADE DRAG COEFFAT  =  6.80000E-03
 12 Q1C       - Q1C COEFFICIENT     =  1.00000E+00
 13 Q2C       - Q2C COEFFICIENT     =  5.00000E-01
 14 ALAMDA    - NONDIM INDUCED VEL  = -1.20000E-02
 15 NXA       - NO. OF STATIONS     =           12
 16 XAERO     - (REAL) NONDIM AERO STATIONS
               1.77000E-01  2.25000E-01  4.00000E-01  6.00000E-01
               7.00000E-01  7.50000E-01  8.00000E-01  8.50000E-01
               9.00000E-01  9.35000E-01  9.70000E-01  1.00000E+00
 17 NUMAF     - NO. AIRFOIL TABLES  =            1
 18 AFTAB1    - NAME AF   TABLE 1   = AFD161  /AIRFOIL
                                                                MORE...
```

```
19 NUMAF1     - NO. OF STATIONS AF 1=            12
20 STA-AF1    - STATIONS FOR AF 1
                    1          2          3          4          5
                    6          7          8          9         10
                   11         12
21 XACC       - (REAL) A/C OFFSET FROM E.C.
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
22 CHORDC     - (REAL) CHORD (IN)
              2.85000E+01  2.85000E+01  2.85000E+01  2.85000E+01
              2.85000E+01  2.85000E+01  2.85000E+01  2.85000E+01
              2.85000E+01  2.85000E+01  2.85000E+01  2.85000E+01
23 NX         - NO. AERO FACTOR STAS=             2
24 XF         - NONDIM FACTOR STAS  =  0.00000E+00  1.00000E+00
25 FL         - FACTORS FOR CL      =  1.00000E+00  1.00000E+00
26 FD         - FACTORS FOR CD      =  1.00000E+00  1.00000E+00
27 FM         - FACTORS FOR CM      =  1.00000E+00  1.00000E+00
*************************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
B2Z1T2
DATA MEMBER
CRE3
B2Z1T2   /CRE3      ON FILE U1

***************        B2Z1T2   /CRE3        ***************

ELASTIC ROTOR WITH 2 OP, 1 IP, 2 TOR MODES

**********************************************************************
INPUT FOR      ROTOR        COMPONENT CRE3. ROTOR ELASTIC BLADES

  1 JV        - INPLANE DOF              =          YES
  2 JW        - OUTPLANE DOF             =          YES
  3 JP        - TORSION DOF              =          YES
  4 JS        - SHAFT PERTURBED DOF      =          NO
  5 JX        - XHUB(LONG) DOF           =          YES
  6 JY        - YHUB(LAT) DOF            =          NO
  7 JZ        - ZHUB(AXIAL) DOF          =          YES
                                                                MORE...


 66 EC1STA    - (REAL) CROSS SEC INTEGRAL
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 67 JIL       - INTERNAL LOADS           =          YES
 68 NXIL      - NO. OF STATIONS          =            10
 69 INDIL     - STATION INDICES
                        1          2          3          4          5
                        6          7          8          9         10
 70 JIPIL     - INPLANE MOMENTS          =          YES
 71 JOPIL     - OUTPLANE MOMENTS         =          YES
 72 JTORIL    - TWIST MOMENTS            =          YES
**********************************************************************


LIST COMPLETE
                                                                MORE...
COMMAND
```

```
LIST
DATA SET
GRAV
DATA MEMBER
CSF1
GRAV     /CSF1      ON FILE U1


***************       GRAV    /CSF1      ***************

GRAVITY VECTORS

**********************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF      - NUMBER OF DOF       =           4
  2 CDFLI     - (DOF) DOF NAMES
           XCG 1000  ZCG 1000  XHUB1000  ZHUB1000
  3 CM        - (REAL) MASS MATRIX
           NULL MATRIX

  4 CC        - (REAL) DAMPING MATRIX
                                                                 MORE...
           NULL MATRIX

  5 CK        - (REAL) STIFFNESS MATRIX
           NULL MATRIX

  6 CF        - (REAL) FORCE VECTOR
            -1.10980E+02 -7.29056E+03 -1.53500E+01 -1.00838E+03
**********************************************************************


LIST COMPLETE
COMMAND
```

```
RUN
MODEL NAME (DATA SET)
AH1G-35A
LIST MODEL SUMMARY (Y OR N)
Y

************************     MODEL AH1G-35A  ********************

AH1G TRIM

INDEX   COMP    NO.   DATA SET        FORCE   DATA SET

  1     CRE3     1    B2Z1T2          FRA3    FCT1.65
                                  REQUIRED DS/DM= AFD161   /AIRFOIL
  2     CCE0     1    3000            NONE
  3     CLC1          COUPLE          NONE
  4     CFM2     1    8300-4          FFC2    AH1G16.5
  5     CSF1          GRAV            NONE

******************************************************************

                                                           MORE...
******************************************************************
                          GLOBAL  VARIABLES

  1 VSOUND    - SOUND VELOCITY        =  1.13800E+03
  2 RHO       - AIR DENSITY RATIO     =  8.79000E-01
******************************************************************


FCT1.65 /FRA3     FOUND ON FOLLOWING MULTIPLES FILES
 R    U1
ENTER CORRECT FILE
R
AH1G16.5/FFC2     FOUND ON FOLLOWING MULTIPLES FILES
 R    U1
ENTER CORRECT FILE
R
TEMPORARY RUN EDIT OF GLOBAL VARIABLES FOR MODEL (Y OR N)
N
TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
******************************************************************
                                                           MORE...
```

```
DETAILS (Y OR N)
Y

***************************************************************************
                    COMPONENT DOF/SYSTEM DOF
               1. 6         2. 7         3. 8         4. 9         5. 10

 1  CRE3     IP   1110     OP   1110     OP   1120     TOR 1110     TOR 1120
             IP   1210     OP   1210     OP   1220     TOR 1210     TOR 1220
             XHUB1000      ZHUB1000      ALFX1000      ALFY1000
             (  -1)        (  -2)        (  -3)        (   1)        (   2)
             (  -4)        (  -5)        (  -6)        (   3)        (   4)
             (  -7)        (  -9)        ( -11)        ( -12)

 2  CCE0     RODR1100      RODR1200
             ( -13)        ( -17)

 3  CLC1     TEET    0     OPOP1120      OPOP1220      IPIP1110      IPIP1210

             (   5)        (   6)        (   7)        (   8)        (   9)
                                                                  MORE...

 4  CFM2     XCG 1000      ZCG 1000      ROLL1000      PTCH1000
             (  10)        (  11)        (  12)        (  13)

 5  CSF1     XCG 1000      ZCG 1000      XHUB1000      ZHUB1000
             (  10)        (  11)        (  -7)        (  -9)


          SYSTEM DOF

           1     TOR 1110
           2     TOR 1120
           3     TOR 1210
           4     TOR 1220
           5     TEET    0
           6     OPOP1120
           7     OPOP1220
           8     IPIP1110
           9     IPIP1210
          10     XCG 1000
          11     ZCG 1000
          12     ROLL1000
                                                                  MORE...
          13     PTCH1000


                    IMPLICIT COEFFICIENTS
```

I	COEF	DOF	I	COEF	DOF
1	2.640E+02	*IPIP1110	11	1.000E+00	*ROLL1000
2	2.640E+02	*TEET 0	12	1.000E+00	*PTCH1000
3	2.640E+02	*OPOP1120	13	-9.250E+00	TOR 1110
4	2.640E+02	*IPIP1210	14	-4.940E-01	TOR 1120
5	-2.640E+02	*TEET 0	15	1.410E+01	TEET 0
6	2.640E+02	*OPOP1220	16	1.245E+00	*OPOP1120
7	1.000E+00	XCG 1000	17	-9.250E+00	TOR 1210
8	9.649E+01	*PTCH1000	18	-4.940E-01	TOR 1220
9	1.000E+00	ZCG 1000	19	-1.410E+01	TEET 0
10	6.800E-01	*PTCH1000	20	1.245E+00	*OPOP1220

```
PRINT MATRICES (Y OR N)
N
**********************************************************************
SOLUTION OR N
STH3
SAVE CASE FOR LATER EXECUTION (Y OR N)
N

                                                               MORE...
SOLUTION STH3. TIME HISTORY

BEGIN INPUT
-----
TSTA      (REAL)
    START TIME
    (SEC)
ENTER 1 REAL VALUE
?
0
-----
H         (REAL)
    INITIAL INCREMENT
    (SEC)
ENTER 1 REAL VALUE
?
.0037037
-----
HTD       (REAL)
    SEPARATE INCREMENT
    TIME DEP COEFS
ENTER 1 REAL VALUE
                                                               MORE...
```

```
?
0
-----
HF        (REAL)
    SEPARATE INCREMENT
    FORCE COMPUTATION
ENTER 1 REAL VALUE
?
0
-----
TEND      (REAL)
    END TIME
    (SEC)
ENTER 1 RE(L VALUE
?
.185185
-----
E         (REAL)
    ERROR CHECK VALUE
    IF 0 THEN CONSTANT INCREMENT USED
ENTER 1 REAL VALUE
?
                                                                  MORE...
0
-----
ICOPT     (INTEGER)
    INITIAL CONDITION
    INPUT TYPE
    0=NONE, 1=SINGLE DISPLACEMENT, 2=GENERAL, 3=CONTINUE
ENTER     1 INTEGER VALUE(S)
2
-----
YV        (REAL)
    INITIAL VELOCITY
    EACH SYSTEM DOF
NULL VECTOR (Y OR N)
N
ENTER 13 REAL VALUE(S)
?
-1.774053 -.015659 1.686185 -.007411 .281252 -.229984 .291828
?
.033634 -.089879 0 0 0 0
-----
YD        (REAL)
    INITIAL DISPLACEMENT
                                                                  MORE...
```

```
    EACH SYSTEM DOF
NULL VECTOR (Y OR N)
N
ENTER 13 REAL VALUE(S)
?
.009831 .005187 -.069426 -.003506 .018313 .028074 .023984
?
-.00445 -.003366 0 0 0 0
-----
ICON      (INTEGER)
    ROTOR CONTROLS
    INPUT TYPE  0 = NULL, 1 = GENERAL, 2 = CONTINUE
ENTER     1 INTEGER VALUE(S)
1
-----
MROT      (INTEGER)
    NUMBER OF ROTORS
ENTER     1 INTEGER VALUE(S)
1
-----
IR1       (INTEGER)
    ROTOR NUMBER
                                                    MORE...
ENTER     1 INTEGER VALUE(S)
1
-----
A01       (REAL)
    COLLECTIVE ANGLE
    (RAD)
ENTER 1 REAL VALUE
?
-.01565
-----
A1C1      (REAL)
    COSINE ANGLE (RAD)
ENTER 1 REAL VALUE
?
.00793
-----
A1S1      (REAL)
    SINE ANGLE (RAD)
ENTER 1 REAL VALUE
?
-.06254
-----
                                                    MORE...
```

```
NH1       (INTEGER)
    HIGHER HARMONIC
    COLLECTIVE HARMONIC, 0=NONE
ENTER     1 INTEGER VALUE(S)
0
-----
ITOUT     (INTEGER)
    ROTOR FORCE OUTPUT
    NO. OF ROTORS
ENTER     1 INTEGER VALUE(S)
1
-----
ITROT     (INTEGER)
    ROTOR NUMBERS
ENTER     1 INTEGER VALUE(S)
1
-----
CRT       (Y OR N)
    OUTPUT THIS TERMINAL
    (Y OR N)
ENTER 1 Y OR N VALUE
Y
                                                              MORE...
-----
ILOP      (Y OR N)
    SAVE STATE VECTORS
    FOR INTERFACE, INTERNAL LOADS CALCULATIONS
ENTER 1 Y OR N VALUE
Y
-----
JIIL      (INTEGER)
    INPUT I, EVERY ITH
    STATE VECTOR TO BE WRITTEN TO LOADS FILE
ENTER     1 INTEGER VALUE(S)
5
*******************************************************************
SOLUTION INPUT FOR STH3.TIME HISTORY

  1 TSTA      - START TIME            =  0.00000E+00
  2 H         - INITIAL INCREMENT     =  3.70370E-03
  3 HTD       - SEPARATE INCREMENT    =  0.00000E+00
  4 HF        - SEPARATE INCREMENT    =  0.00000E+00
  5 TEND      - END TIME              =  1.85185E-01
  6 E         - ERROR CHECK VALUE     =  0.00000E+00
  7 ICOPT     - INITIAL CONDITION     =            2
                                                              MORE...
```

```
 8 YV       - (REAL) INITIAL VELOCITY
           -1.77405E+00 -1.56590E-02  1.68618E+09 -7.41100E-03
            2.81252E-01 -2.29984E-01  2.91828E-01  3.36340E-02
           -8.98790E-02  0.00000E+00  0.00000E+00  0.00000E+00
            0.00000E+00
 9 YD       - (REAL) INITIAL DISPLACEMENT
            9.83100E-03  5.18700E-03 -6.94260E-02 -3.50600E-03
            1.83130E-02  2.80740E-02  2.39840E-02 -4.45000E-03
           -3.36600E-03  0.00000E+00  0.00000E+00  0.00000E+00
            0.00000E+00
10 ICON     - ROTOR CONTROLS       =            1
11 MROT     - NUMBER OF ROTORS     =            1
12 IR1      - ROTOR NUMBER         =            1
13 A01      - COLLECTIVE ANGLE     = -1.56500E-02
14 A1C1     - COSINE ANGLE (RAD)   =  7.93000E-03
15 A1S1     - SINE ANGLE (RAD)     = -6.25400E-02
16 NH1      - HIGHER HARMONIC      =            0
17 ITOUT    - ROTOR FORCE OUTPUT   =            1
18 ITROT    - ROTOR NUMBERS        =            1
19 CRT      - OUTPUT THIS TERMINAL=          YES
20 ILOP     - SAVE STATE VECTORS   =          YES
21 JIIL     - INPUT I, EVERY ITH   =            5
                                                        MORE...
***********************************************************************

RE-ENTER (Y OR N)
N

***************** SOLUTION STH3 FOR MODEL AH1G-35A*****************
MODEL    - AH1G TRIM
SOLUTION - TIME HISTORY


                        TIME HISTORY DISPLACEMENTS

 TIME           TOR 1110       TOR 1120       TOR 1210       TOR 1220
                TEET   0       OPOP1120       OPOP1220       IPIP1110
                IPIP1210       XCG 1000       ZCG 1000       ROLL1000
                PTCH1000
                TORQ1          XFOR1          YFOR1          ZFOR1
 0.0000E+00      9.8310E-03     5.1870E-03    -6.9426E-02    -3.5060E-03
                 1.8313E-02     2.8074E-02     2.3984E-02    -4.4500E-03
                -3.3660E-03     0.0000E+00     0.0000E+00     0.0000E+00
                 0.0000E+00
                                                             MORE...
```

	-1.0157E+05	-3.0206E+02	-3.8798E+02	1.0465E+04
3.7037E-03	2.1781E-03	6.2219E-03	-6.3030E-02	-3.1631E-03
	1.9252E-02	2.7389E-02	2.5137E-02	-4.3766E-03
	-3.7334E-03	2.1965E-04	2.5948E-03	2.3055E-07
	8.8936E-07			
	-1.0133E+05	-2.4708E+02	-4.0820E+02	1.0406E+04
7.4074E-03	-6.9082E-03	8.1780E-03	-5.6254E-02	-2.3459E-03
	1.9979E-02	2.7024E-02	2.6424E-02	-4.4009E-03
	-4.1610E-03	8.7306E-04	1.0388E-02	1.6817E-06
	3.3582E-06			
	-1.0014E+05	-1.9057E+02	-4.1143E+02	1.0291E+04
1.1111E-02	-1.6073E-02	8.7027E-03	-4.8933E-02	-1.5848E-03
	2.0483E-02	2.6947E-02	2.7834E-02	-4.5127E-03
	-4.6336E-03	1.9365E-03	2.3413E-02	5.7165E-06
	6.6925E-06			
	-9.7450E+04	-1.3538E+02	-3.9584E+02	1.0076E+04
1.4815E-02	-2.4364E-02	6.2679E-03	-4.0983E-02	-1.2796E-03
	2.0770E-02	2.7084E-02	2.9363E-02	-4.6970E-03
	-5.1341E-03	3.3725E-03	4.1767E-02	1.4155E-05
	9.7924E-06			
	-9.3206E+04	-8.5652E+01	-3.6012E+02	9.7333E+03
1.8518E-02	-3.1878E-02	1.4043E-03	-3.2557E-02	-1.3770E-03
				MORE...
	2.0864E-02	2.7318E-02	3.1023E-02	-4.9354E-03
	-5.6452E-03	5.1401E-03	6.5637E-02	2.9431E-05
	1.1481E-05			
	-8.7615E+04	-4.6988E+01	-3.0600E+02	9.2804E+03
2.2222E-02	-3.9521E-02	-3.7050E-03	-2.4076E-02	-1.3602E-03
	2.0793E-02	2.7515E-02	3.2822E-02	-5.2053E-03
	-6.1505E-03	7.2059E-03	9.5279E-02	5.4694E-05
	1.0847E-05			
	-8.2316E+04	-2.1571E+01	-2.4389E+02	8.7949E+03
2.5926E-02	-4.8070E-02	-6.9787E-03	-1.6083E-02	-6.0461E-04
	2.0552E-02	2.7574E-02	3.4726E-02	-5.4812E-03
	-6.6365E-03	9.5475E-03	1.3096E-01	9.3810E-05
	7.5209E-06			
	-7.8191E+04	-1.0959E+01	-1.8201E+02	8.3571E+03
2.9630E-02	-5.7353E-02	-7.9977E-03	-8.9876E-03	1.0987E-03
	2.0092E-02	2.7459E-02	3.6645E-02	-5.7356E-03
	-7.0926E-03	1.2152E-02	1.7288E-01	1.5118E-04
	1.8555E-06			
	-7.5870E+04	-1.2927E+01	-1.2748E+02	8.0133E+03

TIME HISTORY DISPLACEMENTS

MORE...

TIME	TOR 1110	TOR 1120	TOR 1210	TOR 1220
	TEET 0	OPOP1120	OPOP1220	IPIP1110
	IPIP1210	XCG 1000	ZCG 1000	ROLL1000
	PTCH1000			
	TORQ1	XFOR1	YFOR1	ZFOR1
3.3333E-02	-6.6242E-02	-8.0972E-03	-2.8728E-03	3.2315E-03
	1.9325E-02	2.7203E-02	3.8440E-02	-5.9411E-03
	-7.5115E-03	1.5012E-02	2.2119E-01	2.3132E-04
	-5.0119E-06			
	-7.4989E+04	-2.5083E+01	-8.3006E+01	7.7616E+03
3.7037E-02	-7.3444E-02	-8.9815E-03	2.4820E-03	4.7371E-03
	1.8164E-02	2.6873E-02	3.9964E-02	-6.0730E-03
	-7.8870E-03	1.8111E-02	2.7597E-01	3.3830E-04
	-1.1270E-05			
	-7.4925E+04	-4.4449E+01	-5.0055E+01	7.5837E+03
4.0741E-02	-7.8440E-02	-1.1038E-02	7.3520E-03	4.6583E-03
	1.6554E-02	2.6523E-02	4.1101E-02	-6.1129E-03
	-8.2131E-03	2.1416E-02	3.3730E-01	4.7509E-04
	-1.4763E-05			
	-7.4941E+04	-6.7745E+01	-3.0430E+01	7.4831E+03
4.4444E-02	-8.1780E-02	-1.2852E-02	1.1766E-02	2.8011E-03
	1.4492E-02	2.6184E-02	4.1789E-02	-6.0504E-03
				MORE...
	-8.4820E-03	2.4857E-02	4.0525E-01	6.4302E-04
	-1.3508E-05			
	-7.4541E+04	-9.1765E+01	-2.5679E+01	7.4986E+03
4.8148E-02	-8.4488E-02	-1.2376E-02	1.5409E-02	-9.1054E-05
	1.2017E-02	2.5879E-02	4.2005E-02	-5.8847E-03
	-8.6835E-03	2.8319E-02	4.7989E-01	8.4113E-04
	-6.2793E-06			
	-7.3474E+04	-1.1361E+02	-3.5250E+01	7.6753E+03
5.1852E-02	-8.7148E-02	-8.6939E-03	1.7849E-02	-2.8410E-03
	9.1965E-03	2.5643E-02	4.1756E-02	-5.6240E-03
	-8.8053E-03	3.1644E-02	5.6118E-01	1.0658E-03
	6.9184E-06			
	-7.2123E+04	-1.3063E+02	-5.4936E+01	8.0128E+03
5.5555E-02	-8.9440E-02	-2.8888E-03	1.8934E-02	-4.6692E-03
	6.1197E-03	2.5524E-02	4.1072E-02	-5.2856E-03
	-8.8338E-03	3.4654E-02	6.4897E-01	1.3109E-03
	2.4632E-05			
	-7.1437E+04	-1.4049E+02	-7.7364E+01	8.4444E+03
5.9259E-02	-9.0503E-02	2.7001E-03	1.9033E-02	-5.6856E-03
	2.9073E-03	2.5554E-02	4.0025E-02	-4.8950E-03
	-8.7564E-03	3.7187E-02	7.4303E-01	1.5686E-03
	4.4164E-05			

MORE...

	-7.1450E+04	-1.4662E+02	-9.6486E+01	8.8681E+03
6.2963E-02	-8.9758E-02	6.1486E-03	1.8860E-02	-6.6008E-03
	-2.8377E-04	2.5714E-02	3.8740E-02	-4.4842E-03
	-8.5641E-03	3.9139E-02	8.4309E-01	1.8312E-03
	6.2248E-05			
	-7.2250E+04	-1.5260E+02	-1.1015E+02	9.1969E+03

TIME HISTORY DISPLACEMENTS

TIME	TOR 1110	TOR 1120	TOR 1210	TOR 1220
	TEET 0	OPOP1120	OPOP1220	IPIP1110
	IPIP1210	XCG 1000	ZCG 1000	ROLL1000
	PTCH1000			
	TORQ1	XFOR1	YFOR1	ZFOR1
6.6666E-02	-8.7467E-02	7.1232E-03	1.8989E-02	-7.8690E-03
	-3.2763E-03	2.5931E-02	3.7378E-02	-4.0882E-03
	-8.2553E-03	4.0490E-02	9.4895E-01	2.0928E-03
	7.5988E-05			
	-7.3605E+04	-1.6259E+02	-1.2088E+02	9.4023E+03
7.0370E-02	-8.4563E-02	6.7110E-03	1.9410E-02	-9.0019E-03
	-5.9116E-03	2.6116E-02	3.6099E-02	-3.7406E-03
	-7.8387E-03	4.1314E-02	1.0605E+00	2.3498E-03
				MORE...
	8.3739E-05			
	-7.5756E+04	-1.7821E+02	-1.3284E+02	9.5194E+03
7.4074E-02	-8.1954E-02	6.2463E-03	1.9526E-02	-8.7091E-03
	-8.0904E-03	2.6205E-02	3.5016E-02	-3.4700E-03
	-7.3340E-03	4.1769E-02	1.1776E+00	2.6012E-03
	8.5581E-05			
	-7.9033E+04	-2.0006E+02	-1.5099E+02	9.6111E+03
7.7777E-02	-7.9843E-02	6.0750E-03	1.8604E-02	-5.8553E-03
	-9.7925E-03	2.6194E-02	3.4176E-02	-3.2967E-03
	-6.7723E-03	4.2072E-02	1.3003E+00	2.8475E-03
	8.3234E-05			
	-8.3888E+04	-2.2621E+02	-1.7886E+02	9.7207E+03
8.1481E-02	-7.7616E-02	5.2850E-03	1.6337E-02	-4.9583E-04
	-1.1067E-02	2.6133E-02	3.3569E-02	-3.2320E-03
	-6.1929E-03	4.2463E-02	1.4284E+00	3.0898E-03
	7.9474E-05			
	-8.9967E+04	-2.5292E+02	-2.2010E+02	9.8506E+03
8.5184E-02	-7.4399E-02	2.7155E-03	1.3024E-02	5.8936E-03
	-1.2002E-02	2.6095E-02	3.3153E-02	-3.2786E-03
	-5.6397E-03	4.3160E-02	1.5619E+00	3.3294E-03
	7.7299E-05			
	-9.6973E+04	-2.7231E+02	-2.7301E+02	9.9791E+03
				MORE...

8.8888E-02	-6.9775E-02	-1.7697E-03	9.2329E-03	1.1242E-02
	-1.2704E-02	2.6163E-02	3.2877E-02	-3.4321E-03
	-5.1562E-03	4.4327E-02	1.7006E+00	3.5672E-03
	7.9140E-05			
	-1.0341E+05	-2.7650E+02	-3.3226E+02	1.0069E+04
9.2592E-02	-6.4056E-02	-6.8363E-03	5.2065E-03	1.4157E-02
	-1.3279E-02	2.6416E-02	3.2675E-02	-3.6822E-03
	-4.7818E-03	4.6047E-02	1.8447E+00	3.8036E-03
	8.6329E-05			
	-1.0808E+05	-2.5963E+02	-3.8685E+02	1.0104E+04
9.6295E-02	-5.7927E-02	-1.0455E-02	5.2895E-04	1.4680E-02
	-1.3837E-02	2.6944E-02	3.2463E-02	-4.0141E-03
	-4.5461E-03	4.8317E-02	1.9942E+00	4.0389E-03
	9.8962E-05			
	-1.1004E+05	-2.2178E+02	-4.2576E+02	1.0087E+04

TIME HISTORY DISPLACEMENTS

TIME	TOR 1110	TOR 1120	TOR 1210	TOR 1220
	TEET 0	OPOP1120	OPOP1220	IPIP1110
	IPIP1210	XCG 1000	ZCG 1000	ROLL1000
	PTCH1000			
				MORE...
	TORQ1	XFOR1	YFOR1	ZFOR1
9.9999E-02	-5.1834E-02	-1.1237E-02	-5.6046E-03	1.3891E-02
	-1.4477E-02	2.7837E-02	3.2138E-02	-4.4101E-03
	-4.4657E-03	5.1067E-02	2.1491E+00	4.2733E-03
	1.1615E-04			
	-1.0903E+05	-1.6792E+02	-4.3974E+02	1.0010E+04
1.0370E-01	-4.5620E-02	-9.2830E-03	-1.3699E-02	1.2694E-02
	-1.5257E-02	2.9156E-02	3.1613E-02	-4.8518E-03
	-4.5406E-03	5.4190E-02	2.3096E+00	4.5068E-03
	1.3658E-04			
	-1.0511E+05	-1.0696E+02	-4.2305E+02	9.8505E+03
1.0741E-01	-3.8730E-02	-5.9143E-03	-2.3433E-02	1.0882E-02
	-1.6168E-02	3.0890E-02	3.0847E-02	-5.3225E-03
	-4.7531E-03	5.7576E-02	2.4756E+00	4.7399E-03
	1.5919E-04			
	-9.9090E+04	-4.8752E+01	-3.7527E+02	9.5641E+03
1.1111E-01	-3.0773E-02	-2.6098E-03	-3.3739E-02	7.2863E-03
	-1.7120E-02	3.2944E-02	2.9860E-02	-5.8095E-03
	-5.0686E-03	6.1148E-02	2.6471E+00	4.9729E-03
	1.8384E-04			
	-9.1316E+04	-3.7058E+00	-2.9770E+02	9.1044E+03
1.1481E-01	-2.1966E-02	-3.6893E-05	-4.3508E-02	1.0582E-03
				MORE...

	-1.7962E-02	3.5141E-02	2.8718E-02	-6.3041E-03
	-5.4389E-03	6.4888E-02	2.8244E+00	5.2061E-03
	2.1179E-04			
	-8.3218E+04	2.2059E+01	-2.0204E+02	8.4845E+03
1.1852E-01	-1.3110E-02	2.0918E-03	-5.2298E-02	-7.1223E-03
	-1.8516E-02	3.7275E-02	2.7495E-02	-6.8007E-03
	-5.8083E-03	6.8840E-02	3.0074E+00	5.4387E-03
	2.4573E-04			
	-7.6538E+04	2.7053E+01	-1.0422E+02	7.7797E+03
1.2222E-01	-5.1352E-03	4.3391E-03	-6.0463E-02	-1.5004E-02
	-1.8624E-02	3.9140E-02	2.6249E-02	-7.2942E-03
	-6.1206E-03	7.3091E-02	3.1964E+00	5.6692E-03
	2.8916E-04			
	-7.3751E+04	1.6568E+01	-2.1931E+01	7.1220E+03
1.2592E-01	1.4090E-03	6.7113E-03	-6.8584E-02	-2.0031E-02
	-1.8159E-02	4.0563E-02	2.5023E-02	-7.7762E-03
	-6.3270E-03	7.7738E-02	3.3915E+00	5.8954E-03
	3.4534E-04			
	-7.4223E+04	-5.4078E+00	3.5238E+01	6.6431E+03
1.2963E-01	6.5470E-03	8.3872E-03	-7.6709E-02	-2.0942E-02
	-1.7034E-02	4.1407E-02	2.3868E-02	-8.2324E-03
	-6.3907E-03	8.2829E-02	3.5927E+00	6.1156E-03
				MORE...
	4.1619E-04			
	-7.6263E+04	-3.4994E+01	6.4102E+01	6.4217E+03

TIME HISTORY DISPLACEMENTS

TIME	TOR 1110	TOR 1120	TOR 1210	TOR 1220
	TEET 0	OPOP1120	OPOP1220	IPIP1110
	IPIP1210	XCG 1000	ZCG 1000	ROLL1000
	PTCH1000			
	TORQ1	XFOR1	YFOR1	ZFOR1
1.3333E-01	1.0666E-02	8.2126E-03	-8.4061E-02	-1.8447E-02
	-1.5205E-02	4.1575E-02	2.2851E-02	-8.6409E-03
	-6.2902E-03	8.8320E-02	3.7999E+00	6.3284E-03
	5.0149E-04			
	-7.7671E+04	-6.8180E+01	6.7217E+01	6.4542E+03
1.3703E-01	1.4124E-02	5.5384E-03	-8.9477E-02	-1.4503E-02
	-1.2687E-02	4.1033E-02	2.2037E-02	-8.9718E-03
	-6.0210E-03	9.4058E-02	4.0131E+00	6.5326E-03
	5.9860E-04			
	-7.7217E+04	-9.9238E+01	5.0766E+01	6.6790E+03
1.4074E-01	1.7003E-02	7.5636E-04	-9.2267E-02	-1.0743E-02
	-9.5796E-03	3.9833E-02	2.1449E-02	-9.1892E-03
				MORE...

	-5.5957E-03	9.9787E-02	4.2320E+00	6.7259E-03
	7.0275E-04			
	-7.5148E+04	-1.2288E+02	2.3102E+01	7.0221E+03
1.4444E-01	1.9142E-02	-4.8295E-03	-9.2783E-02	-7.3442E-03
	-6.0732E-03	3.8124E-02	2.1049E-02	-9.2557E-03
	-5.0437E-03	1.0520E-01	4.4565E+00	6.9046E-03
	8.0754E-04			
	-7.2457E+04	-1.3630E+02	-7.0551E+00	7.4308E+03
1.4815E-01	2.0393E-02	-9.6660E-03	-9.2172E-02	-3.3367E-03
	-2.4199E-03	3.6125E-02	2.0746E-02	-9.1385E-03
	-4.4071E-03	1.1002E-01	4.6866E+00	7.0639E-03
	9.0592E-04			
	-7.0891E+04	-1.4089E+02	-3.2306E+01	7.8740E+03
1.5185E-01	2.0847E-02	-1.2672E-02	-9.1537E-02	2.0166E-03
	1.1190E-03	3.4073E-02	2.0441E-02	-8.8168E-03
	-3.7358E-03	1.1403E-01	4.9222E+00	7.1996E-03
	9.9141E-04			
	-7.1063E+04	-1.4308E+02	-4.8854E+01	8.3147E+03
1.5555E-01	2.0864E-02	-1.3563E-02	-9.1169E-02	8.0203E-03
	4.3298E-03	3.2167E-02	2.0069E-02	-8.2874E-03
	-3.0804E-03	1.1717E-01	5.1630E+00	7.3097E-03
	1.0595E-03			
				MORE...
	-7.3125E+04	-1.5024E+02	-5.7705E+01	8.6933E+03
1.5926E-01	2.0888E-02	-1.2675E-02	-9.0467E-02	1.2571E-02
	7.0794E-03	3.0540E-02	1.9617E-02	-7.5690E-03
	-2.4870E-03	1.1953E-01	5.4089E+00	7.3951E-03
	1.1088E-03			
	-7.6830E+04	-1.6777E+02	-6.4209E+01	8.9454E+03
1.6296E-01	2.1183E-02	-1.0500E-02	-8.8599E-02	1.3518E-02
	9.3170E-03	2.9255E-02	1.9111E-02	-6.7024E-03
	-1.9935E-03	1.2134E-01	5.6597E+00	7.4593E-03
	1.1410E-03			
	-8.1517E+04	-1.9765E+02	-7.7016E+01	9.0415E+03

TIME HISTORY DISPLACEMENTS

TIME	TOR 1110	TOR 1120	TOR 1210	TOR 1220
	TEET 0	OPOP1120	OPOP1220	IPIP1110
	IPIP1210	XCG 1000	ZCG 1000	ROLL1000
	PTCH1000			
	TORQ1	XFOR1	YFOR1	ZFOR1
1.6666E-01	2.1654E-02	-7.[illegible]E-03	[illegible].5359E-02	1.0345E-02
	1.1059E-02	2.[illegible]E-02	1.8588E-02	-5.7469E-03
	-1.6282E-03	1.2290E-01	5.9153E+00	7.5071E-03
				MORE...

	1.1610E-03			
	-8.7043E+04	-2.3611E+02	-1.0356E+02	9.0176E+03
1.7037E-01	2.1846E-02	-3.0545E-03	-8.1416E-02	4.6456E-03
	1.2375E-02	2.7721E-02	1.8100E-02	-4.7748E-03
	-1.4092E-03	1.2457E-01	6.1754E+00	7.5435E-03
	1.1746E-03			
	-9.3760E+04	-2.7514E+02	-1.4656E+02	8.9547E+03
1.7407E-01	2.1177E-02	2.2252E-03	-7.7770E-02	-1.0180E-03
	1.3382E-02	2.7375E-02	1.7720E-02	-3.8636E-03
	-1.3447E-03	1.2664E-01	6.4402E+00	7.5724E-03
	1.1881E-03			
	-1.0150E+05	-3.0723E+02	-2.0670E+02	8.9344E+03
1.7777E-01	1.9182E-02	8.1072E-03	-7.4922E-02	-4.7914E-03
	1.4236E-02	2.7179E-02	1.7562E-02	-3.0887E-03
	-1.4339E-03	1.2933E-01	6.7096E+00	7.5965E-03
	1.2061E-03			
	-1.0968E+05	-3.2435E+02	-2.7923E+02	8.9941E+03
1.8148E-01	1.5725E-02	1.3537E-02	-7.2422E-02	-6.5508E-03
	1.5109E-02	2.7002E-02	1.7768E-02	-2.5154E-03
	-1.6679E-03	1.3273E-01	6.9836E+00	7.6170E-03
	1.2308E-03			
	-1.1676E+05	-3.1991E+02	-3.5447E+02	9.0909E+03
				MORE...
1.8518E-01	1.0977E-02	1.7107E-02	-6.9191E-02	-7.4928E-03
	1.6148E-02	2.6723E-02	1.8466E-02	-2.1913E-03
	-2.0313E-03	1.3680E-01	7.2621E+00	7.6345E-03
	1.2623E-03			
	-1.2100E+05	-2.9097E+02	-4.1721E+02	9.1430E+03
1.8519E-01	1.0972E-02	1.7109E-02	-6.9187E-02	-7.4937E-03
	1.6149E-02	2.6723E-02	1.8467E-02	-2.1911E-03
	-2.0317E-03	1.3680E-01	7.2623E+00	7.6345E-03
	1.2624E-03			
	-1.2110E+05	-2.9114E+02	-4.1782E+02	9.1465E+03

*** TIME HISTORY SOLUTION COMPLETE ***

STATE VECTOR AT T= 1.85185E-01

DOF	VELOCITY	DISPLACEMENT
TOR 1110	-1.43374E+00	1.09716E-02
TOR 1120	5.98976E-01	1.71088E-02

MORE...

```
TOR 1210    1.06336E+00  -6.91870E-02
TOR 1220   -2.58674E-01  -7.49373E-03
TEET    0   3.12230E-01   1.61493E-02
OPOP1120   -9.76570E-02   2.67225E-02
OPOP1220    2.63362E-01   1.84668E-02
IPIP1110    5.09470E-02  -2.19110E-03
IPIP1210   -1.14001E-01  -2.03168E-03
XCG 1000    1.18108E+00   1.36803E-01
ZCG 1000    7.58040E+01   7.26233E+00
ROLL1000    4.32850E-03   7.63450E-03
PTCH1000    9.24421E-03   1.26238E-03
*****************************************************************
COMMAND
```

2.4.6 STH4 - Time History. Inputs for two solutions are presented. In the first example, a solution is performed for a ground resonance model similar to the model formulated in Section 5 of the User's Manual. The initial integration increment has been set equal to a fraction of the rotation period of the rotor, and the error check has been invoked. A displacement of 0.1 radian for the blade 1 lag degree of freedom has been input for the initial condition.

The displacement and velocity for a combination of system and component degrees of freedom are output, and the time history system state vectors for every other time increment are saved.

The component displacements and velocities can be verified against the system displacements and velocities using the implicit coefficients table in the model details. In the details, the positive integers in parentheses under the degree of freedom names indicate system degrees of freedom, the negative integers index the implicit coefficients, and zero indicates that a degree of freedom has been eliminated. In this example Y2000 is replaced by

(1.0 x YCG1000) + (75.76 x ROLL1000)

Substituting the output displacements/velocities for YCG1000 and ROLL1000 yields the output displacement/velocity for Y2000. Outputs for Z1000, Y1000, and Z2000 correlate in a similar manner.

In the second example, a solution is performed for the spring-mass-damper system shown in Figure 11. A displacement of 1 inch for degree of freedom X has been input for the initial condition. Note that outputs for the print and plot options are selected independently. Also, the time history system state vectors for every fifth time increment are saved (see paragraph 2.4.7).

Note that the final solution increment converges because of the difference between the specified end time and the computed increment.

```
RUN
MODEL NAME (DATA SET)
LAT
LIST MODEL SUMMARY (Y OR N)
Y

*************************     MODEL LAT     *************************

LATERAL GROUND RESONANCE MODEL

INDEX   COMP    NO.   DATA SET     FORCE   DATA SET

  1     CRR2     1    ROTLAT       NONE
  2     CFM2     1    FUSLAT       NONE
  3     CSF1          LMAIN        NONE
  4     CSF1          RMAIN        NONE
  5     CSF1          TAIL         NONE
  6     CLC1          CGEAR        NONE
*********************************************************************
                                                              MORE...
*********************************************************************
                           GLOBAL  VARIABLES

 NO INPUT REQUIRED
*********************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
*******************************************************************
DETAILS (Y OR N)
Y

 ******************************************************************
                    COMPONENT DOF/SYSTEM DOF
            1, 6        2, 7        3, 8        4, 9        5, 10

  1  CRR2     ZETA1100    ZETA1200    ZETA1300    ZETA1400    YHUB1000
              ALFX1000
                                                              MORE...
```

```
          (    1)       (    2)       (    3)       (    4)       (   -1)
          (   -3)

2  CFM2   YCG 1000     ROLL1000
          (    5)      (    6)

3  CSF1   X    2000    Y    2000     Z    2000
          (    0)      (   -4)       (   -6)

4  CSF1   X    1000    Y    1000     Z    1000
          (    0)      (   -7)       (   -9)

5  CSF1   X    3000    Y    3000     Z    3000
          (    0)      (  -10)       (    0)

6  CLC1   YCG 1000     ROLL1000
          (    5)      (    6)

      SYSTEM DOF

        1    ZETA1100
                                                                  MORE...
        2    ZETA1200
        3    ZETA1300
        4    ZETA1400
        5    YCG 1000
        6    ROLL1000

                    IMPLICIT COEFFICIENTS

    I      COEF          DOF         I      COEF          DOF

    1    9.976E-01     YCG 1000      7    1.000E+00     YCG 1000
    2   -8.403E+01    *ROLL1000      8    7.576E+01    *ROLL1000
    3    9.945E-01    *ROLL1000      9    6.600E+01    *ROLL1000
    4    1.000E+00     YCG 1000     10    1.000E+00     YCG 1000
    5    7.576E+01    *ROLL1000     11    7.576E+01    *ROLL1000
    6   -6.600E+01    *ROLL1000
PRINT MATRICES (Y OR N)
N
*********************************************************************
SOLUTION OR N
STH4
                                                                  MORE...
```

```
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION STH4. TIME HISTORY

BEGIN INPUT
-----
TSTA      (REAL)
    START TIME
    (SEC)
ENTER 1 REAL VALUE
?
0
-----
H         (REAL)
    INITIAL INCREMENT
    (SEC)
ENTER 1 REAL VALUE
?
.0096962
-----
                                                            MORE...
HTD       (REAL)
    SEPARATE INCREMENT
    TIME DEP COEFS
ENTER 1 REAL VALUE
?
0
-----
HF        (REAL)
    SEPARATE INCREMENT
    FORCE COMPUTATION
ENTER 1 REAL VALUE
?
0
-----
TEND      (REAL)
    END TIME
    (SEC)
ENTER 1 REAL VALUE
?
.193924
-----
E         (REAL)
                                                            MORE...
```

```
    ERROR CHECK VALUE
    IF 0 THEN CONSTANT INCREMENT USED
ENTER 1 REAL VALUE
?
.0001
-----
IDFLI    (SYSTEM DOFS CHOSEN)
    TEST DOF
    NAME  (A4,I4)
SYSTEM DOFS
    1 ZETA1100      2 ZETA1200      3 ZETA1300      4 ZETA1400
    5 YCG 1000      6 ROLL1000

SELECT ONE SYSTEM DOF BY INDEX
1
-----
ICOPT    (INTEGER)
    INITIAL CONDITION
    INPUT TYPE
    0=NONE, 1=SINGLE DISPLACEMENT, 2=GENERAL, 3=CONTINUE
ENTER    1 INTEGER VALUE(S)
1
                                                                  MORE...
-----
VI       (REAL)
    INITIAL DISPLACEMENT
    SINGLE SYSTEM DOF (IN OR RAD)
ENTER 1 REAL VALUE
?
.1
-----
IIDFLI   (SYSTEM DOFS CHOSEN)
    DOF NAME
    INITIAL CONDITION
SYSTEM DOFS
    1 ZETA1100      2 ZETA1200      3 ZETA1300      4 ZETA1400
    5 YCG 1000      6 ROLL1000

SELECT ONE SYSTEM DOF BY INDEX
1
-----
CRT      (Y OR N)
    OUTPUT THIS TERMINAL
    (Y OR N)
ENTER 1 Y OR N VALUE
                                                                  MORE...
```

```
Y
-----
PROP      (INTEGER)
    PRINT
    1=DISPLACEMENT 2=VELOCITY 3=BOTH
ENTER    1 INTEGER VALUE(S)
3
-----
DOFPRINT (MODEL DOFS CHOSEN )
    DOFS TO BE PRINTED
SYSTEM DOFS
    1 ZETA1100      2 ZETA1200      3 ZETA1300      4 ZETA1400
    5 YCG 1000      6 ROLL1000

ALL SYSTEM DOFS (Y OR N)
N
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
1 5 6 0
ANY COMPONENT DOFS (Y OR N)
Y

                                                              MORE...
SET OF COMPONENTS
   1 ROTLAT  /CRR2
   2 FUSLAT  /CFM2
   3 LMAIN   /CSF1
   4 RMAIN   /CSF1
   5 TAIL    /CSF1
   6 CGEAR   /CLC1
SELECT COMPONENTS BY INDICES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
3 4 0
DOFS FOR COMPONENT LMAIN   /CSF1
    1 X   2000      2 Y   2000      3 Z   2000

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
2 3 0
DOFS FOR COMPONENT RMAIN   /CSF1
    1 X   1000      2 Y   1000      3 Z   1000

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
                                                              MORE...
```

```
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER          0
2 3 0
-----
PLOP      (INTEGER)
    PLOT
    0=NONE 1=DISPLACEMENT 2=VELOCITY 3=BOTH
ENTER     1 INTEGER VALUE(S)
0
-----
FLOP      (Y OR N)
    CONDITION CODES
    TO BE OUTPUT (Y OR N)
ENTER 1 Y OR N VALUE
N
-----
ILOP      (Y OR N)
    SAVE STATE VECTORS
    FOR INTERFACE, INTERNAL LOADS CALCULATIONS
ENTER 1 Y OR N VALUE
Y
                                                                  MORE...
-----
JIIL      (INTEGER)
    INPUT I, EVERY ITH
    STATE VECTOR TO BE WRITTEN TO LOADS FILE
ENTER     1 INTEGER VALUE(S)
2
*****************************************************************
SOLUTION INPUT FOR STH4.TIME HISTORY

  1 TSTA      - START TIME            =  0.00000E+00
  2 H         - INITIAL INCREMENT     =  9.69620E-03
  3 HTD       - SEPARATE INCREMENT    =  0.00000E+00
  4 HF        - SEPARATE INCREMENT    =  0.00000E+00
  5 TEND      - END TIME              =  1.93924E-01
  6 E         - ERROR CHECK VALUE     =  1.00000E-04
  7 IDFLI     - (SYSTEM DOF SELECTED)
                TEST DOF               = ZETA1100
  8 ICOPT     - INITIAL CONDITION     =            1
  9 VI        - INITIAL DISPLACEMENT=  1.00000E-01
 10 IIDFLI    - (SYSTEM DOF SELECTED)
                DOF NAME               = ZETA1100
 11 CRT       - OUTPUT THIS TERMINAL=          YES
                                                                  MORE...
```

```
12 PROP      - PRINT                    =              3
13 DOFPRINT - (MODEL DOFS SELECTED) DOFS TO BE PRINTED
    SYSTEM DOFS SELECTED
         ZETA1100   YCG 1000  ROLL1000
   COMPONENT LMAIN    /CSF1 DOFS
         Y   2000  Z   2000
   COMPONENT RMAIN    /CSF1 DOFS
         Y   1000  Z   1000
14 PLOP      - PLOT                     =              0
15 FLOP      - CONDITION CODES          =           NO
16 ILOP      - SAVE STATE VECTORS       =           YES
17 JIIL      - INPUT I, EVERY ITH       =              2
*********************************************************************

RE-ENTER (Y OR N)
N

**************** SOLUTION STH4 FOR MODEL LAT      *****************
MODEL    - LATERAL GROUND RESONANCE MODEL
SOLUTION - TIME HISTORY


                                                               MORE...

                          TIME HISTORY DISPLACEMENTS AND VELOCITIES

 TIME              ZETA1100         YCG 1000         ROLL1000         Y    2000
                   Z    2000        Y    1000        Z    1000
  0.0000E+00        1.0000E-01       0.0000E+00       0.0000E+00       0.0000E+00
                    0.0000E+00       0.0000E+00       0.0000E+00
  0.0000E+00        0.0000E+00       0.0000E+00       0.0000E+00       0.0000E+00
                    0.0000E+00       0.0000E+00       0.0000E+00
  9.6962E-03        9.9431E-02       1.0035E-02      -2.1703E-04      -6.4080E-03
                    1.4324E-02      -6.4080E-03      -1.4324E-02
  9.6962E-03       -1.1591E-01       2.0464E+00      -4.3810E-02      -1.2727E+00
                    2.8915E+00      -1.2727E+00      -2.8915E+00
  1.9392E-02        9.7790E-02       3.8781E-02      -8.1975E-04      -2.3323E-02
                    5.4103E-02      -2.3323E-02      -5.4103E-02
  1.9392E-02       -2.2019E-01       3.8152E+00      -7.8469E-02      -2.1296E+00
                    5.1790E+00      -2.1296E+00      -5.1790E+00
  2.9089E-02        9.5212E-02       8.2355E-02      -1.6911E-03      -4.5763E-02
                    1.1161E-01      -4.5763E-02      -1.1161E-01
  2.9089E-02       -3.0910E-01       5.0723E+00      -9.8517E-02      -2.3914E+00
                    6.5021E+00      -2.3914E+00      -6.5021E+00
  3.8785E-02        9.1841E-02       1.3500E-01      -2.6734E-03      -6.7540E-02
                                                                     MORE...
```

	1.7645E-01	-6.7540E-02	-1.7645E-01	
3.8785E-02	-3.8427E-01	5.6703E+00	-1.0115E-01	-1.9926E+00
	6.6758E+00	-1.9926E+00	-6.6758E+00	
4.8481E-02	8.7786E-02	1.9005E-01	-3.5966E-03	-8.2435E-02
	2.3738E-01	-8.2435E-02	-2.3738E-01	
4.8481E-02	-4.5136E-01	5.5708E+00	-8.6615E-02	-9.9121E-01
	5.7166E+00	-9.9121E-01	-5.7166E+00	
5.8177E-02	8.3093E-02	2.4099E-01	-4.3075E-03	-8.5342E-02
	2.8429E-01	-8.5342E-02	-2.8429E-01	
5.8177E-02	-5.1672E-01	4.8449E+00	-5.8083E-02	4.4452E-01
	3.8335E+00	4.4452E-01	-3.8335E+00	
6.7873E-02	7.7759E-02	2.8250E-01	-4.6950E-03	-7.3198E-02
	3.0987E-01	-7.3198E-02	-3.0987E-01	
6.7873E-02	-5.8388E-01	3.6566E+00	-2.0969E-02	2.0680E+00
	1.3840E+00	2.0680E+00	-1.3840E+00	
7.7569E-02	7.1767E-02	3.1113E-01	-4.7078E-03	-4.5535E-02
	3.1072E-01	-4.5535E-02	-3.1072E-01	
7.7569E-02	-6.5177E-01	2.2296E+00	1.8081E-02	3.5995E+00
	-1.1934E+00	3.5995E+00	1.1934E+00	
8.7265E-02	6.5133E-02	3.2575E-01	-4.3598E-03	-4.5525E-03
	2.8775E-01	-4.5525E-03	-2.8775E-01	
8.7265E-02	-7.1523E-01	8.0495E-01	5.2412E-02	4.7757E+00
				MORE...
	-3.4592E+00	4.7757E+00	3.4592E+00	
9.6962E-02	5.7932E-02	3.2745E-01	-3.7248E-03	4.5261E-02
	2.4584E-01	4.5261E-02	-2.4584E-01	
9.6962E-02	-7.6777E-01	-4.0198E-01	7.6517E-02	5.3949E+00
	-5.0501E+00	5.3949E+00	5.0501E+00	
1.0666E-01	5.0295E-02	3.1916E-01	-2.9205E-03	9.7902E-02
	1.9275E-01	9.7902E-02	-1.9275E-01	
1.0666E-01	-8.0471E-01	-1.2380E+00	8.6963E-02	5.3504E+00
	-5.7396E+00	5.3504E+00	5.7396E+00	
1.1635E-01	4.2380E-02	3.0487E-01	-2.0857E-03	1.4686E-01
	1.3765E-01	1.4686E-01	-1.3765E-01	
1.1635E-01	-8.2538E-01	-1.6357E+00	8.2905E-02	4.6453E+00
	-5.4717E+00	4.6453E+00	5.4717E+00	
1.2605E-01	3.4331E-02	2.8879E-01	-1.3543E-03	1.8618E-01
	8.9384E-02	1.8618E-01	-8.9384E-02	
1.2605E-01	-8.3309E-01	-1.6205E+00	6.6116E-02	3.3884E+00
	-4.3636E+00	3.3884E+00	4.3636E+00	
1.3575E-01	2.6250E-02	2.7444E-01	-8.3215E-04	2.1140E-01
	5.4922E-02	2.1140E-01	-5.4922E-02	
1.3575E-01	-8.3304E-01	-1.3000E+00	4.0547E-02	1.7718E+00
	-2.6761E+00	1.7718E+00	2.6761E+00	
1.4544E-01	1.8187E-02	2.6403E-01	-5.7926E-04	2.2015E-01
				MORE...

	3.8231E-02	2.2015E-01	-3.8231E-02	
1.4544E-01	-8.2954E-01	-8.3870E-01	1.1518E-02	3.3943E-02
	-7.6022E-01	3.3943E-02	7.6022E-01	
1.5514E-01	1.0170E-02	2.5803E-01	-6.0159E-04	2.1245E-01
	3.9705E-02	2.1245E-01	-3.9705E-02	
1.5514E-01	-8.2376E-01	-4.2264E-01	-1.5312E-02	-1.5827E+00
	1.0106E+00	-1.5827E+00	-1.0106E+00	
1.6483E-01	2.2269E-03	2.5513E-01	-8.5286E-04	1.9052E-01
	5.6289E-02	1.9052E-01	-5.6289E-02	
1.6483E-01	-8.1347E-01	-2.2164E-01	-3.4998E-02	-2.8731E+00
	2.3099E+00	-2.8731E+00	-2.3099E+00	
1.7453E-01	-5.5775E-03	2.5264E-01	-1.2460E-03	1.5824E-01
	8.2237E-02	1.5824E-01	-8.2237E-02	
1.7453E-01	-7.9456E-01	-3.5526E-01	-4.4187E-02	-3.7029E+00
	2.9164E+00	-3.7029E+00	-2.9164E+00	
1.8423E-01	-1.3142E-02	2.4700E-01	-1.6716E-03	1.2037E-01
	1.1032E-01	1.2037E-01	-1.1032E-01	
1.8423E-01	-7.6369E-01	-8.6925E-01	-4.1677E-02	-4.0267E+00
	2.7507E+00	-4.0267E+00	-2.7507E+00	
1.9392E-01	-2.0347E-02	2.3466E-01	-2.0196E-03	8.1657E-02
	1.3329E-01	8.1657E-02	-1.3329E-01	
1.9392E-01	-7.2041E-01	-1.7263E+00	-2.8555E-02	-3.8896E+00
				MORE...
	1.8846E+00	-3.8896E+00	-1.8846E+00	
1.9392E-01	-2.0347E-02	2.3466E-01	-2.0196E-03	8.1655E-02
	1.3329E-01	8.1655E-02	-1.3329E-01	
1.9392E-01	-7.2041E-01	-1.7263E+00	-2.8554E-02	-3.8896E+00
	1.8845E+00	-3.8896E+00	-1.8845E+00	
1.9392E-01	-2.0348E-02	2.3466E-01	-2.0196E-03	8.1652E-02
	1.3330E-01	8.1652E-02	-1.3330E-01	
1.9392E-01	-7.2040E-01	-1.7264E+00	-2.8552E-02	-3.8895E+00
	1.8845E+00	-3.8895E+00	-1.8845E+00	

*** TIME HISTORY SOLUTION COMPLETE ***

SYSTEM STATE VECTOR AT T = 1.93924E-01

DOF	VELOCITY	DISPLACEMENT
ZETA1100	-7.20403E-01	-2.03477E-02
ZETA1200	-6.16191E-02	-6.29539E-03
ZETA1300	-4.28237E-03	1.12289E-02

MORE...

```
        ZETA1400   6.16192E-02   6.29539E-03
        YCG 1000  -1.72642E+00   2.34659E-01
        ROLL1000  -2.85524E-02  -2.01963E-03
****************************************************************
COMMAND
```

```
RUN
MODEL NAME (DATA SET)
AD
LIST MODEL SUMMARY (Y OR N)
Y

************************        MODEL AD        *********************

SMD SYSTEM WITH ADDITIONAL DAMPERS

INDEX    COMP     NO.    DATA SET         FORCE   DATA SET

   1      CSF1           SMD              NONE
   2      CSF1           C5               NONE
   3      CSF1           C6               NONE

*******************************************************************

*******************************************************************
                                  GLOBAL  VARIABLES,

                                                               MORE...
 NO INPUT REQUIRED
*******************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
*******************************************************************
DETAILS (Y OR N)
N
PRINT MATRICES (Y OR N)
N
*******************************************************************
SOLUTION OR N
STH4
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION STH4. TIME HISTORY

BEGIN INPUT
                                                               MORE...
```

```
-----
TSTA      (REAL)
    START TIME
    (SEC)
ENTER 1 REAL VALUE
?
0
-----
H         (REAL)
    INITIAL INCREMENT
    (SEC)
ENTER 1 REAL VALUE
?
.1
-----
HTD       (REAL)
    SEPARATE INCREMENT
    TIME DEP COEFS
ENTER 1 REAL VALUE
?
0
-----
                                                                MORE...
HF        (REAL)
    SEPARATE INCREMENT
    FORCE COMPUTATION
ENTER 1 REAL VALUE
?
0
-----
TEND      (REAL)
    END TIME
    (SEC)
ENTER 1 REAL VALUE
?
5
-----
E         (REAL)
    ERROR CHECK VALUE
    IF 0 THEN CONSTANT INCREMENT USED
ENTER 1 REAL VALUE
?
0
-----
ICOPT     (INTEGER)
                                                                MORE...
```

```
    INITIAL CONDITION
    INPUT TYPE
    0=NONE, 1=SINGLE DISPLACEMENT, 2=GENERAL, 3=CONTINUE
ENTER    1 INTEGER VALUE(S)
1
-----
VI        (REAL)
    INITIAL DISPLACEMENT
    SINGLE SYSTEM DOF (IN OR RAD)
ENTER 1 REAL VALUE
?
1
-----
IIDFLI    (SYSTEM DOFS CHOSEN)
    DOF NAME
    INITIAL CONDITION
SYSTEM DOFS
    1 X       0      2 Y       0      3 Z       0

SELECT ONE SYSTEM DOF BY INDEX
1
-----
                                                        MORE...
CRT       (Y OR N)
    OUTPUT THIS TERMINAL
    (Y OR N)
ENTER 1 Y OR N VALUE
Y
-----
PROP      (INTEGER)
    PRINT
    1=DISPLACEMENT 2=VELOCITY 3=BOTH
ENTER    1 INTEGER VALUE(S)
1
-----
DOFPRINT (MODEL DOFS CHOSEN )
    DOFS TO BE PRINTED
SYSTEM DOFS
    1 X       0      2 Y       0      3 Z       0

ALL SYSTEM DOFS (Y OR N)
Y
ANY COMPONENT DOFS (Y OR N)
N
-----
                                                        MORE...
```

```
PLOP      (INTEGER)
    PLOT
    0=NONE 1=DISPLACEMENT 2=VELOCITY 3=BOTH
ENTER     1 INTEGER VALUE(S)
3
-----
JPLT      (INTEGER)
    INPUT N, EVERY NTH
    SOLUTION TO BE WRITTEN TO PLOT FILE
ENTER     1 INTEGER VALUE(S)
1
-----
DOFPLOT  (MODEL DOFS CHOSEN )
    DOFS TO BE PLOTTED
SYSTEM DOFS
    1 X       0      2 Y       0      3 Z       0

ALL SYSTEM DOFS (Y OR N)
N
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER         0
1 0
                                                               MORE...
ANY COMPONENT DOFS (Y OR N)
Y

SET OF COMPONENTS
   1 SMD      /CSF1
   2 C5       /CSF1
   3 C6       /CSF1
SELECT COMPONENTS BY INDICES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER         0
1 0
DOFS FOR COMPONENT SMD      /CSF1
    1 Y       0      2 Z       0

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER         0
1 2 0
-----
FLOP      (Y OR N)
    CONDITION CODES
    TO BE OUTPUT (Y OR N)
                                                               MORE...
```

```
ENTER 1 Y OR N VALUE
N
-----
ILOP      (Y OR N)
    SAVE STATE VECTORS
    FOR INTERFACE, INTERNAL LOADS CALCULATIONS
ENTER 1 Y OR N VALUE
Y
-----
JIIL      (INTEGER)
    INPUT I, EVERY ITH
    STATE VECTOR TO BE WRITTEN TO LOADS FILE
ENTER     1 INTEGER VALUE(S)
5
********************************************************************
SOLUTION INPUT FOR STH4.TIME HISTORY

  1 TSTA      - START TIME           =  0.00000E+00
  2 H         - INITIAL INCREMENT    =  1.00000E-01
  3 HTD       - SEPARATE INCREMENT   =  0.00000E+00
  4 HF        - SEPARATE INCREMENT   =  0.00000E+00
  5 TEND      - END TIME             =  5.00000E+00
                                                             MORE...
  6 E         - ERROR CHECK VALUE    =  0.00000E+00
  7 ICOPT     - INITIAL CONDITION    =            1
  8 VI        - INITIAL DISPLACEMENT=  1.00000E+00
  9 IIDFLI    - (SYSTEM DOF SELECTED)
                DOF NAME             = X      0
 10 CRT       - OUTPUT THIS TERMINAL=         YES
 11 PROP      - PRINT                =            1
 12 DOFPRINT  - (MODEL DOFS SELECTED) DOFS TO BE PRINTED
      SYSTEM DOFS SELECTED
           X      0  Y      0  Z      0
 13 PLOP      - PLOT                 =            3
 14 JPLT      - INPUT N, EVERY NTH   =            1
 15 DOFPLOT   - (MODEL DOFS SELECTED) DOFS TO BE PLOTTED
      SYSTEM DOFS SELECTED
           X      0
     COMPONENT SMD     /CSF1 DOFS
           Y      0  Z      0
 16 FLOP      - CONDITION CODES      =         NO
 17 ILOP      - SAVE STATE VECTORS   =         YES
 18 JIIL      - INPUT I, EVERY ITH   =            5
********************************************************************
                                                             MORE...
```

RE-ENTER (Y OR N)
N

```
***************** SOLUTION STH4 FOR MODEL AD        *****************
MODEL    - SMD SYSTEM WITH ADDITIONAL DAMPERS
SOLUTION - TIME HISTORY
```

TIME HISTORY DISPLACEMENTS

TIME	X 0	Y 0	Z 0
0.0000E+00	1.0000E+00	0.0000E+00	0.0000E+00
1.0000E-01	8.8771E-01	3.6323E-02	-4.1319E-03
2.0000E-01	6.6589E-01	1.0074E-01	-2.2327E-02
3.0000E-01	4.4497E-01	1.4660E-01	-4.8640E-02
4.0000E-01	2.7054E-01	1.5577E-01	-7.0419E-02
5.0000E-01	1.5164E-01	1.3157E-01	-7.9917E-02
6.0000E-01	7.9425E-02	8.8015E-02	-7.6306E-02
7.0000E-01	3.9343E-02	4.0635E-02	-6.3534E-02
8.0000E-01	1.7983E-02	9.2600E-04	-4.7171E-02
9.0000E-01	5.8930E-03	-2.5543E-02	-3.1936E-02

MORE...

TIME	X 0	Y 0	Z 0
1.0000E+00	-2.1813E-03	-3.8420E-02	-2.0513E-02
1.1000E+00	-8.3429E-03	-4.0611E-02	-1.3512E-02
1.2000E+00	-1.2922E-02	-3.6211E-02	-1.0092E-02
1.3000E+00	-1.5630E-02	-2.8969E-02	-8.7916E-03
1.4000E+00	-1.6261E-02	-2.1497E-02	-8.2107E-03
1.5000E+00	-1.4973E-02	-1.5146E-02	-7.3983E-03
1.6000E+00	-1.2254E-02	-1.0270E-02	-5.9540E-03
1.7000E+00	-8.7606E-03	-6.6478E-03	-3.9254E-03
1.8000E+00	-5.1332E-03	-3.8662E-03	-1.6170E-03
1.9000E+00	-1.8654E-03	-1.5691E-03	5.9993E-04
2.0000E+00	7.4863E-04	4.3588E-04	2.4217E-03
2.1000E+00	2.6031E-03	2.1813E-03	3.6765E-03
2.2000E+00	3.7324E-03	3.6022E-03	4.3282E-03
2.3000E+00	4.2514E-03	4.6092E-03	4.4446E-03
2.4000E+00	4.3044E-03	5.1451E-03	4.1510E-03
2.5000E+00	4.0306E-03	5.2111E-03	3.5887E-03
2.6000E+00	3.5466E-03	4.8670E-03	2.8860E-03
2.7000E+00	2.9429E-03	4.2139E-03	2.1432E-03
2.8000E+00	2.2870E-03	3.3705E-03	1.4306E-03
2.9000E+00	1.6291E-03	2.4514E-03	7.9133E-04
3.0000E+00	1.0072E-03	1.5524E-03	2.4909E-04
3.1000E+00	4.5054E-04	7.4276E-04	-1.8600E-04

MORE...

```
   3.2000E+00      -2.0030E-05       6.5348E-05      -5.1245E-04
   3.3000E+00      -3.9136E-04      -4.6037E-04      -7.3447E-04
   3.4000E+00      -6.5830E-04      -8.3264E-04      -8.6046E-04
   3.5000E+00      -8.2334E-04      -1.0619E-03      -9.0211E-04
   3.6000E+00      -8.9558E-04      -1.1660E-03      -8.7372E-04
   3.7000E+00      -8.8907E-04      -1.1668E-03      -7.9125E-04
   3.8000E+00      -8.2093E-04      -1.0875E-03      -6.7131E-04
   3.9000E+00      -7.0931E-04      -9.5106E-04      -5.2995E-04
   4.0000E+00      -5.7174E-04      -7.7896E-04      -3.8162E-04
   4.1000E+00      -4.2383E-04      -5.9042E-04      -2.3837E-04
   4.2000E+00      -2.7847E-04      -4.0173E-04      -1.0937E-04
   4.2999E+00      -1.4545E-04      -2.2583E-04      -7.5023E-07
   4.3999E+00      -3.1451E-05      -7.2144E-05       8.4167E-05
   4.4999E+00       5.9728E-05       5.3366E-05       1.4455E-04
   4.5999E+00       1.2674E-04       1.4796E-04       1.8152E-04

                       TIME HISTORY DISPLACEMENTS

  TIME             X       0        Y       0        Z      0
   4.6999E+00       1.7023E-04       2.1164E-04       1.9764E-04
   4.7999E+00       1.9235E-04       2.4663E-04       1.9638E-04
   4.8999E+00       1.9622E-04       2.5668E-04       1.8166E-04
                                                                    MORE...
   4.9999E+00       1.8556E-04       2.4652E-04       1.5747E-04
   5.0000E+00       1.8555E-04       2.4651E-04       1.5746E-04


          *** TIME HISTORY SOLUTION COMPLETE ***

SYSTEM STATE VECTOR AT T =   5.00000E+00

           DOF        VELOCITY     DISPLACEMENT


          X       0  -1.66317E-04   1.85554E-04
          Y       0  -1.85780E-04   2.46513E-04
          Z       0  -2.76475E-04   1.57456E-04
*******************************************************************
COMMAND
```

2.4.7 SII3 - Component Interface and Internal Loads. Inputs for two solutions are presented. In the first example, internal loads are computed from the time history solution of the spring-mass-damper system presented in paragraph 2.4.6. Internal loads are computed for the degrees of freedom of SMD/CSF1. Note that interface loads and internal loads may only be calculated for one component at a time.

The force and strain energy at time zero reflect the initial displacement of X with respect to Y. Subsequently, forces are generated between X and Y and Y and Z. Because there is no internal connection between X and Z, no forces, etc., are generated.

In the second example, interface and internal loads are computed for B2Z1T2/CRE3 from the time history solution presented in paragraph 2.4.5. The interface loads acting at the hub and the blade moments acting at stations 1 - 10 are output. The types of moments to be computed and the blade station selections are included in the CRE3 data set. Therefore, only the data set and at least one internal degree of freedom need be selected at solution time. Internal loads are output first, followed by the interface loads.

```
RUN
MODEL NAME (DATA SET)
AD
LIST MODEL SUMMARY (Y OR N)
Y

*************************      MODEL AD       *********************

SMD SYSTEM WITH ADDITIONAL DAMPERS

INDEX    COMP     NO.   DATA SET        FORCE    DATA SET

  1      CSF1           SMD             NONE
  2      CSF1           C5              NONE
  3      CSF1           C6              NONE

*******************************************************************

*******************************************************************
                           GLOBAL  VARIABLES
                                                            MORE...
 NO INPUT REQUIRED
*******************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
*******************************************************************
DETAILS (Y OR N)
N
PRINT MATRICES (Y OR N)
N
*******************************************************************
SOLUTION OR N
SII3
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION SII3. TIME HISTORY LOADS

BEGIN INPUT
                                                            MORE...
```

```
-----
IFL       (Y OR N)
    INTERFACE LOADS
    OPTION
ENTER 1 Y OR N VALUE
N
-----
INL       (Y OR N)
    INTERNAL LOADS
    OPTION
ENTER 1 Y OR N VALUE
Y
-----
INLDF     (COMPONENT DOFS )
    INTERNAL DOF
    SELECT ONLY ONE COMPONENT

SET OF COMPONENTS
   1 SMD      /CSF1
   2 C5       /CSF1
   3 C6       /CSF1
SELECT COMPONENTS BY INDICES
                                                                   MORE...
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
1 0
DOFS FOR COMPONENT SMD     /CSF1
    1 X       0      2 Y       0     3 Z       0

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
1 2 3 0
*******************************************************************
SOLUTION INPUT FOR SII3.TIME HISTORY LOADS

  1 IFL      - INTERFACE LOADS     =         NO
  2 INL      - INTERNAL LOADS      =         YES
  3 INLDF    - (COMPONENT DOFS SELECTED) INTERNAL DOF
     COMPONENT SMD     /CSF1 DOFS
          X      0 Y       0 Z      0
*******************************************************************

RE-ENTER (Y OR N)
N
                                                                   MORE...
```

```
***************** SOLUTION S113 FOR MODEL AD        *****************
MODEL     - SMD SYSTEM WITH ADDITIONAL DAMPERS
SOLUTION  - TIME HISTORY LOADS


WARNING:

SOLUTION NOT VALID IF TEMP EDIT WAS USED WITH TIME
HISTORY RUN OR WITH THIS SOLUTION

SOLUTION NOT VALID IF SEPARATE TIME INCREMENTS
(HTD,HF) HAVE BEEN USED IN TIME HISTORY RUN


                    TIME HISTORY INTERNAL LOADS FOR SMD      /CSF1

*************** TIME   0.0000E+00 ***************

             INTERNAL DOF
                                                           MORE...
             X      0     Y      0

             FORCES

 INTERNAL DOF

 Y      0     -2.0000E+01
 Z      0      0.0000E+00   0.0000E+00

             STRAIN ENERGY

 INTERNAL DOF

 Y      0      1.0000E+01
 Z      0      0.0000E+00   0.0000E+00

             ENERGY DISSIPATION RATE

 INTERNAL DOF

 Y      0      0.0000E+00
 Z      0      0.0000E+00   0.0000E+00
                                                           MORE...
```

```
*************** TIME   5.0000E-01 ***************

          INTERNAL DOF

          X      0      Y      0

          FORCES

 INTERNAL DOF

 Y      0      7.9382E-01
 Z      0      0.0000E+00  -5.3799E+00

          STRAIN ENERGY

 INTERNAL DOF

 Y      0      4.0269E-03
 Z      0      0.0000E+00   6.7092E-01

          ENERGY DISSIPATION RATE
                                                        MORE...

 INTERNAL DOF

 Y      0      3.5710E-01
 Z      0      0.0000E+00   1.5515E-01

*************** TIME   1.0000E+00 ***************

          INTERNAL DOF

          X      0      Y      0

          FORCES

 INTERNAL DOF

 Y      0     -7.3580E-01
 Z      0      0.0000E+00   1.0338E+00

          STRAIN ENERGY

 INTERNAL DOF
                                                        MORE...
```

```
Y        0      1.3132E-02
Z        0      0.0000E+00   4.8095E-03

              ENERGY DISSIPATION RATE

 INTERNAL DOF

Y        0      3.0424E-05
Z        0      0.0000E+00   4.1097E-02

*************** TIME   1.5000E+00 ***************

              INTERNAL DOF

              X        0      Y        0

              FORCES

 INTERNAL DOF

Y        0      6.9026E-02
                                                          MORE...
Z        0      0.0000E+00   9.3380E-02

              STRAIN ENERGY

 INTERNAL DOF

Y        0      2.9993E-07
Z        0      0.0000E+00   9.0043E-04

              ENERGY DISSIPATION RATE

 INTERNAL DOF

Y        0      1.3137E-03
Z        0      0.0000E+00   3.2227E-03
```

```
*************** TIME   3.0000E+00 ***************

          INTERNAL DOF

          X      0     Y      0

          FORCES

 INTERNAL DOF

 Y      0     5.4783E-03
 Z      0     0.0000E+00  -2.7859E-02

          STRAIN ENERGY

 INTERNAL DOF

 Y      0     2.9716E-06
                                               MORE...
 Z      0     0.0000E+00   2.5478E-05

          ENERGY DISSIPATION RATE

 INTERNAL DOF

 Y      0     7.3551E-06
 Z      0     0.0000E+00   2.1052E-05

*************** TIME   3.5000E+00 ***************

          INTERNAL DOF

          X      0     Y      0

          FORCES

 INTERNAL DOF

 Y      0    -5.7071E-03
 Z      0     0.0000E+00   9.5841E-03

                                               MORE...
```

STRAIN ENERGY

INTERNAL DOF

```
Y        0     5.6904E-07
Z        0     0.0000E+00    3.8293E-07
```

ENERGY DISSIPATION RATE

INTERNAL DOF

```
Y        0     2.1914E-07
Z        0     0.0000E+00    3.8253E-06
```

*************** TIME 4.0000E+00 ***************

INTERNAL DOF

```
X        0        Y        0
```

FORCES

MORE...

INTERNAL DOF

```
Y        0    -3.3804E-03
Z        0     0.0000E+00    1.0848E-02
```

STRAIN ENERGY

INTERNAL DOF

```
Y        0     4.2942E-07
Z        0     0.0000E+00    2.3682E-06
```

ENERGY DISSIPATION RATE

INTERNAL DOF

```
Y        0     1.4597E-07
Z        0     0.0000E+00    1.9143E-07
```

*************** TIME 4.4999E+00 ***************

INTERNAL DOF

MORE...

X 0 Y 0

FORCES

INTERNAL DOF

```
Y      0      4.9619E-04
Z      0      0.0000E+00   8.7573E-04
```

STRAIN ENERGY

INTERNAL DOF

```
Y      0      4.0473E-10
Z      0      0.0000E+00   1.2471E-07
```

ENERGY DISSIPATION RATE

INTERNAL DOF

```
Y      0      9.7164E-08
```

MORE...

```
Z      0      0.0000E+00   5.7640E-07
```

*************** TIME 4.9999E+00 ***************

INTERNAL DOF

X 0 Y 0

FORCES

INTERNAL DOF

```
Y      0      1.1809E-03
Z      0      0.0000E+00  -2.9458E-03
```

STRAIN ENERGY

INTERNAL DOF

```
Y      0      3.7161E-08
Z      0      0.0000E+00   1.1895E-07
```

MORE...

```
          ENERGY DISSIPATION RATE

 INTERNAL DOF

 Y      0     3.6709E-10
 Z      0     0.0000E+00   1.2539E-08
************************************************************
COMMAND
```

```
RUN
MODEL NAME (DATA SET)
AH1G-35A
LIST MODEL SUMMARY (Y OR N)
Y

************************      MODEL AH1G-35A  ********************

AH1G TRIM

INDEX    COMP     NO.    DATA SET         FORCE    DATA SET

  1      CRE3      1     B2Z1T2           FRA3     FCT1.65
                                    REQUIRED DS/DM= AFD161  /AIRFOIL
  2      CCE0      1     3000             NONE
  3      CLC1            COUPLE           NONE
  4      CFM2      1     8300-4           FFC2     AH1G16.5
  5      CSF1            GRAV             NONE

*******************************************************************
                                                            MORE...
*******************************************************************
                             GLOBAL  VARIABLES

  1 VSOUND    - SOUND VELOCITY        =  1.13800E+03
  2 RHO       - AIR DENSITY RATIO     =  8.79000E-01
*******************************************************************


FCT1.65 /FRA3      FOUND ON FOLLOWING MULTIPLES FILES
 R    U1
ENTER CORRECT FILE
R
AH1G16.5/FFC2      FOUND ON FOLLOWING MULTIPLES FILES
 R    U1
ENTER CORRECT FILE
R
TEMPORARY RUN EDIT OF GLOBAL VARIABLES FOR MODEL (Y OR N)
N
TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
*******************************************************************
                                                            MORE...
DETAILS (Y OR N)
```

```
N
PRINT MATRICES (Y OR N)
N
*******************************************************************************
SOLUTION OR N
SII3
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION SII3. TIME HISTORY LOADS

BEGIN INPUT
-----
IFL       (Y OR N)
    INTERFACE LOADS
    OPTION
ENTER 1 Y OR N VALUE
Y
-----
IFLDF     (COMPONENT DOFS )
    INTERFACE DOF
                                                                  MORE...
    SELECT ONLY ONE COMPONENT

SET OF COMPONENTS
   1 B2Z1T2  /CRE3
   2 3000    /CCE0
   3 COUPLE  /CLC1
   4 8300-4  /CFM2
SELECT COMPONENTS BY INDICES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
1 0
DOFS FOR COMPONENT B2Z1T2  /CRE3
    1 IP   1110      2 OP   1110      3 OP   1120      4 TOR 1110
    5 TOR 1120       6 IP   1210      7 OP   1210      8 OP   1220
    9 TOR 1210      10 TOR 1220      11 XHUB1000      12 ZHUB1000
   13 ALFX1000      14 ALFY1000

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
11 12 13 14 0
-----
                                                                  MORE...
```

```
IFLPL     (Y OR N)
    PLOT INTERFACE LOADS
ENTER 1 Y OR N VALUE
N
------
INL       (Y OR N)
    INTERNAL LOADS
    OPTION
ENTER 1 Y OR N VALUE
Y
-----
INLDF     (COMPONENT DOFS )
    INTERNAL DOF
    SELECT ONLY ONE COMPONENT

SET OF COMPONENTS
   1 B2Z1T2  /CRE3
   2 3000    /CCE0
   3 COUPLE  /CLC1
   4 8300-4  /CFM2
SELECT COMPONENTS BY INDICES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
                                                                  MORE...
1 0
DOFS FOR COMPONENT B2Z1T2  /CRE3
    1 IP  1110     2 OP  1110     3 OP  1120     4 TOR 1110
    5 TOR 1120     6 IP  1210     7 OP  1210     8 OP  1220
    9 TOR 1210    10 TOR 1220    11 XHUB1000    12 ZHUB1000
   13 ALFX1000    14 ALFY1000

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
1 0
************************************************************************
SOLUTION INPUT FOR SII3.TIME HISTORY LOADS

  1 IFL      - INTERFACE LOADS      =          YES
  2 IFLDF    - (COMPONENT DOFS SELECTED) INTERFACE DOF
     COMPONENT B2Z1T2  /CRE3 DOFS
           XHUB1000  ZHUB1000  ALFX1000  ALFY1000
  3 IFLPL    - PLOT INTERFACE LOADS=         NO
  4 INL      - INTERNAL LOADS       =          YES
  5 INLDF    - (COMPONENT DOFS SELECTED) INTERNAL DOF
                                                                  MORE...
```

COMPONENT B2Z1T2 /CRE3 DOFS
IP 1110
****

RE-ENTER (Y OR N)
N

***************** SOLUTION SI13 FOR MODEL AH1G-35A*****************
MODEL - AH1G TRIM
SOLUTION - TIME HISTORY LOADS

WARNING:

SOLUTION NOT VALID IF TEMP EDIT WAS USED WITH TIME HISTORY RUN OR WITH THIS SOLUTION

SOLUTION NOT VALID IF SEPARATE TIME INCREMENTS (HTD,HF) HAVE BEEN USED IN TIME HISTORY RUN

MORE...

TIME HISTORY INTERNAL LOADS FOR B2Z1T2 /CRE3

BLADE MOMENTS

TIME	BLADE	STATION	INPLANE	OUTPLANE
0.0000E+00	1	1	-1.4533E+06	6.5627E+03
0.0000E+00	1	2	-1.9328E+06	-1.5804E+03
0.0000E+00	1	3	-5.4969E+05	2.6049E+03
0.0000E+00	1	4	-4.7553E+05	1.6883E+03
0.0000E+00	1	5	-4.0325E+05	5.0363E+02
0.0000E+00	1	6	-1.4598E+06	4.4656E+03
0.0000E+00	1	7	-1.5002E+06	3.1075E+03
0.0000E+00	1	8	-1.0489E+06	1.5734E+03
0.0000E+00	1	9	-7.0042E+05	7.6781E+02
0.0000E+00	1	10	-4.8652E+05	3.4124E+02
0.0000E+00	2	1	-1.2460E+06	2.7916E+03
0.0000E+00	2	2	-1.6334E+06	-4.1992E+03
0.0000E+00	2	3	-4.6965E+05	4.6745E+02
0.0000E+00	2	4	-4.0557E+05	-4.3271E+01
0.0000E+00	2	5	-3.4392E+05	-1.2960E+01
0.0000E+00	2	6	-1.2558E+06	1.9268E+03

MORE...

0.0000E+00	2	7	-1.2914E+06	1.3258E+03
0.0000E+00	2	8	-9.0093E+05	5.3453E+02
0.0000E+00	2	9	-6.0005E+05	1.3912E+02
0.0000E+00	2	10	-4.1582E+05	-3.3137E+01

BLADE MOMENTS

TIME	BLADE	STATION	INPLANE	OUTPLANE
1.8518E-02	1	1	-1.4270E+06	3.2358E+03
1.8518E-02	1	2	-1.8934E+06	-6.9690E+03
1.8518E-02	1	3	-5.3863E+05	4.5387E+02
1.8518E-02	1	4	-4.6570E+05	-2.1498E+02
1.8518E-02	1	5	-3.9491E+05	-6.4191E+01
1.8518E-02	1	6	-1.4312E+06	2.7012E+03
1.8518E-02	1	7	-1.4703E+06	1.9436E+03
1.8518E-02	1	8	-1.0270E+06	8.3573E+02
1.8518E-02	1	9	-6.8507E+05	2.7293E+02
1.8518E-02	1	10	-4.7537E+05	1.4843E+01
1.8518E-02	2	1	-1.6211E+06	3.5670E+03
1.8518E-02	2	2	-2.1511E+06	-8.1521E+03
1.8518E-02	2	3	-6.1186E+05	4.2513E+02

MORE...

1.8518E-02	2	4	-5.2901E+05	-3.2852E+02
1.8518E-02	2	5	-4.4860E+05	-9.8076E+01
1.8518E-02	2	6	-1.6258E+06	2.9973E+03
1.8518E-02	2	7	-1.6701E+06	2.1575E+03
1.8518E-02	2	8	-1.1666E+06	9.1388E+02
1.8518E-02	2	9	-7.7814E+05	2.8379E+02
1.8518E-02	2	10	-5.3992E+05	-1.7839E+00

BLADE MOMENTS

TIME	BLADE	STATION	INPLANE	OUTPLANE
3.7037E-02	1	1	-1.4172E+06	-9.9395E+02
3.7037E-02	1	2	-1.8792E+06	-1.4941E+04
3.7037E-02	1	3	-5.3353E+05	-2.3910E+03
3.7037E-02	1	4	-4.6103E+05	-2.7848E+03
3.7037E-02	1	5	-3.9095E+05	-8.3086E+02
3.7037E-02	1	6	-1.4172E+06	6.1035E+02
3.7037E-02	1	7	-1.4549E+06	5.9379E+02
3.7037E-02	1	8	-1.0152E+06	-5.0546E+01
3.7037E-02	1	9	-6.7628E+05	-3.4463E+02
3.7037E-02	1	10	-4.6863E+05	-4.0590E+02

MORE...

3.7037E-02	2	1	-2.0902E+06	6.1965E+03
3.7037E-02	2	2	-2.7986E+06	-9.5799E+03
3.7037E-02	2	3	-7.9025E+05	1.5276E+03
3.7037E-02	2	4	-6.8395E+05	3.7603E+02
3.7037E-02	2	5	-5.7999E+05	1.1211E+02
3.7037E-02	2	6	-2.0902E+06	5.1056E+03
3.7037E-02	2	7	-2.1457E+06	3.6838E+03
3.7037E-02	2	8	-1.5007E+06	1.7194E+03
3.7037E-02	2	9	-1.0024E+06	7.0396E+02
3.7037E-02	2	10	-6.9642E+05	2.0521E+02

BLADE MOMENTS

TIME	BLADE	STATION	INPLANE	OUTPLANE
5.5555E-02	1	1	-1.3415E+06	-8.9463E+02
5.5555E-02	1	2	-1.7690E+06	-1.3103E+04
5.5555E-02	1	3	-5.0476E+05	-2.1457E+03
5.5555E-02	1	4	-4.3594E+05	-2.4872E+03
5.5555E-02	1	5	-3.6968E+05	-7.4208E+02
5.5555E-02	1	6	-1.3445E+06	4.5860E+02
5.5555E-02	1	7	-1.3809E+06	4.5486E+02

MORE...

5.5555E-02	1	8	-9.6311E+05	-9.0244E+01
5.5555E-02	1	9	-6.4122E+05	-3.3536E+02
5.5555E-02	1	10	-4.4414E+05	-3.7886E+02
5.5555E-02	2	1	-2.1547E+06	6.4266E+03
5.5555E-02	2	2	-2.9039E+06	-1.1279E+04
5.5555E-02	2	3	-8.1532E+05	1.4373E+03
5.5555E-02	2	4	-7.0610E+05	1.9456E+02
5.5555E-02	2	5	-5.9877E+05	5.7951E+01
5.5555E-02	2	6	-2.1494E+06	5.4589E+03
5.5555E-02	2	7	-2.2053E+06	3.9605E+03
5.5555E-02	2	8	-1.5434E+06	1.8329E+03
5.5555E-02	2	9	-1.0317E+06	7.3423E+02
5.5555E-02	2	10	-7.1723E+05	1.9846E+02

BLADE MOMENTS

TIME	BLADE	STATION	INPLANE	OUTPLANE
7.4074E-02	1	1	-1.3606E+06	2.7901E+03
7.4074E-02	1	2	-1.7787E+06	-4.4579E+03
7.4074E-02	1	3	-5.1257E+05	4.2531E+02
7.4074E-02	1	4	-4.4252E+05	-9.3984E+01

MORE...

7.4074E-02	1	5	-3.7526E+05	-2.8086E+01
7.4074E-02	1	6	-1.3722E+06	1.9352E+03
7.4074E-02	1	7	-1.4113E+06	1.3318E+03
7.4074E-02	1	8	-9.8426E+05	5.2906E+02
7.4074E-02	1	9	-6.5536E+05	1.2892E+02
7.4074E-02	1	10	-4.5404E+05	-4.3544E+01
7.4074E-02	2	1	-1.8343E+06	5.8468E+03
7.4074E-02	2	2	-2.4694E+06	-8.7482E+03
7.4074E-02	2	3	-6.9412E+05	1.4533E+03
7.4074E-02	2	4	-6.0108E+05	3.7657E+02
7.4074E-02	2	5	-5.0971E+05	1.1226E+02
7.4074E-02	2	6	-1.8312E+06	4.7567E+03
7.4074E-02	2	7	-1.8792E+06	3.4242E+03
7.4074E-02	2	8	-1.3151E+06	1.5953E+03
7.4074E-02	2	9	-8.7901E+05	6.5038E+02
7.4074E-02	2	10	-6.1102E+05	1.8699E+02

BLADE MOMENTS

TIME	BLADE	STATION	INPLANE	OUTPLANE
9.2592E-02	1	1	-1.3716E+06	3.3825E+03

MORE...

9.2592E-02	1	2	-1.7990E+06	-4.1812E+03
9.2592E-02	1	3	-5.1713E+05	6.9388E+02
9.2592E-02	1	4	-4.4661E+05	1.0666E+02
9.2592E-02	1	5	-3.7873E+05	3.1759E+01
9.2592E-02	1	6	-1.3826E+06	2.2709E+03
9.2592E-02	1	7	-1.4218E+06	1.5547E+03
9.2592E-02	1	8	-9.9201E+05	6.4506E+02
9.2592E-02	1	9	-6.6079E+05	1.8863E+02
9.2592E-02	1	10	-4.5795E+05	-1.4443E+01
9.2592E-02	2	1	-1.6874E+06	8.0214E+03
9.2592E-02	2	2	-2.2370E+06	-4.8396E+02
9.2592E-02	2	3	-6.3803E+05	3.3816E+03
9.2592E-02	2	4	-5.5180E+05	2.3123E+03
9.2592E-02	2	5	-4.6793E+05	6.8980E+02
9.2592E-02	2	6	-1.6971E+06	5.3447E+03
9.2592E-02	2	7	-1.7444E+06	3.7045E+03
9.2592E-02	2	8	-1.2194E+06	1.9112E+03
9.2592E-02	2	9	-8.1401E+05	9.6506E+02
9.2592E-02	2	10	-5.6531E+05	4.5452E+02

BLADE MOMENTS

MORE...

TIME	BLADE	STATION	INPLANE	OUTPLANE
1.1111E-01	1	1	-1.7192E+06	4.2108E+03
1.1111E-01	1	2	-2.2798E+06	-7.7221E+03
1.1111E-01	1	3	-6.4897E+05	7.3295E+02
1.1111E-01	1	4	-5.6108E+05	-8.9738E+01
1.1111E-01	1	5	-4.7580E+05	-2.6842E+01
1.1111E-01	1	6	-1.7252E+06	3.3482E+03
1.1111E-01	1	7	-1.7725E+06	2.3877E+03
1.1111E-01	1	8	-1.2381E+06	1.0363E+03
1.1111E-01	1	9	-8.2583E+05	3.4926E+02
1.1111E-01	1	10	-5.7301E+05	3.2001E+01
1.1111E-01	2	1	-1.5564E+06	3.9832E+03
1.1111E-01	2	2	-2.0607E+06	-6.3327E+03
1.1111E-01	2	3	-5.8746E+05	8.5368E+02
1.1111E-01	2	4	-5.0784E+05	1.0933E+02
1.1111E-01	2	5	-4.3065E+05	3.2563E+01
1.1111E-01	2	6	-1.5628E+06	3.1330E+03
1.1111E-01	2	7	-1.6057E+06	2.2332E+03
1.1111E-01	2	8	-1.1215E+06	9.9979E+02
1.1111E-01	2	9	-7.4801E+05	3.6900E+02
1.1111E-01	2	10	-5.1901E+05	7.0242E+01

MORE...

BLADE MOMENTS

TIME	BLADE	STATION	INPLANE	OUTPLANE
1.2963E-01	1	1	-2.1657E+06	6.6359E+03
1.2963E-01	1	2	-2.9027E+06	-9.7369E+03
1.2963E-01	1	3	-8.1895E+05	1.7417E+03
1.2963E-01	1	4	-7.0888E+05	5.2627E+02
1.2963E-01	1	5	-6.0113E+05	1.5693E+02
1.2963E-01	1	6	-2.1648E+06	5.4795E+03
1.2963E-01	1	7	-2.2221E+06	3.9585E+03
1.2963E-01	1	8	-1.5543E+06	1.8717E+03
1.2963E-01	1	9	-1.0384E+06	7.8960E+02
1.2963E-01	1	10	-7.2159E+05	2.5192E+02
1.2963E-01	2	1	-1.2675E+06	-2.7294E+03
1.2963E-01	2	2	-1.6887E+06	-1.7820E+04
1.2963E-01	2	3	-4.7673E+05	-3.4700E+03
1.2963E-01	2	4	-4.1200E+05	-3.7380E+03
1.2963E-01	2	5	-3.4937E+05	-1.1152E+03
1.2963E-01	2	6	-1.2628E+06	-2.2308E+02
1.2963E-01	2	7	-1.2954E+06	6.4484E+01

MORE...

1.2963E-01	2	8	-9.0385E+05	-3.8098E+02
1.2963E-01	2	9	-6.0195E+05	-5.6351E+02
1.2963E-01	2	10	-4.1698E+05	-5.4901E+02

BLADE MOMENTS

TIME	BLADE	STATION	INPLANE	OUTPLANE
1.4815E-01	1	1	-1.9133E+06	3.4728E+03
1.4815E-01	1	2	-2.5993E+06	-1.5605E+04
1.4815E-01	1	3	-7.2397E+05	-3.1864E+02
1.4815E-01	1	4	-6.2737E+05	-1.3273E+03
1.4815E-01	1	5	-5.3201E+05	-3.9607E+02
1.4815E-01	1	6	-1.8998E+06	4.0001E+03
1.4815E-01	1	7	-1.9471E+06	3.0269E+03
1.4815E-01	1	8	-1.3634E+06	1.2688E+03
1.4815E-01	1	9	-9.1182E+05	3.7419E+02
1.4815E-01	1	10	-6.3416E+05	-2.9129E+01
1.4815E-01	2	1	-1.0912E+06	-1.0242E+03
1.4815E-01	2	2	-1.4392E+06	-1.1274E+04
1.4815E-01	2	3	-4.1049E+05	-1.9466E+03
1.4815E-01	2	4	-3.5451E+05	-2.2072E+03

MORE...

1.4815E-01	2	5	-3.0063E+05	-6.5853E+02
1.4815E-01	2	6	-1.0933E+06	2.4000E+02
1.4815E-01	2	7	-1.1228E+06	2.8713E+02
1.4815E-01	2	8	-7.8301E+05	-1.2914E+02
1.4815E-01	2	9	-5.2126E+05	-3.1265E+02
1.4815E-01	2	10	-3.6102E+05	-3.3593E+02

BLADE MOMENTS

TIME	BLADE	STATION	INPLANE	OUTPLANE
1.6666E-01	1	1	-1.4810E+06	5.1521E+03
1.6666E-01	1	2	-1.9918E+06	-6.1326E+03
1.6666E-01	1	3	-5.6050E+05	1.4734E+03
1.6666E-01	1	4	-4.8534E+05	5.8030E+02
1.6666E-01	1	5	-4.1157E+05	1.7306E+02
1.6666E-01	1	6	-1.4795E+06	4.0348E+03
1.6666E-01	1	7	-1.5186E+06	2.8859E+03
1.6666E-01	1	8	-1.0628E+06	1.3710E+03
1.6666E-01	1	9	-7.1032E+05	5.8543E+02
1.6666E-01	1	10	-4.9377E+05	1.9350E+02
1.6666E-01	2	1	-9.5824E+05	3.2829E+03

MORE...

1.6666E-01	2	2	-1.2445E+06	3.0306E+02
1.6666E-01	2	3	-3.6110E+05	1.2425E+03
1.6666E-01	2	4	-3.1162E+05	8.2588E+02
1.6666E-01	2	5	-2.6426E+05	2.4635E+02
1.6666E-01	2	6	-9.7022E+05	1.8267E+03
1.6666E-01	2	7	-9.9869E+05	1.1961E+03
1.6666E-01	2	8	-6.9631E+05	5.6708E+02
1.6666E-01	2	9	-4.6352E+05	2.4502E+02
1.6666E-01	2	10	-3.2108E+05	8.5228E+01

BLADE MOMENTS

TIME	BLADE	STATION	INPLANE	OUTPLANE
1.8518E-01	1	1	-1.3567E+06	9.7176E+03
1.8518E-01	1	2	-1.7748E+06	7.2875E+03
1.8518E-01	1	3	-5.1303E+05	4.9855E+03
1.8518E-01	1	4	-4.4325E+05	3.9690E+03
1.8518E-01	1	5	-3.7588E+05	1.1841E+03
1.8518E-01	1	6	-1.3750E+06	5.5814E+03
1.8518E-01	1	7	-1.4159E+06	3.7331E+03
1.8518E-01	1	8	-9.8898E+05	2.0695E+03

MORE...

1.8518E-01	1	9	-6.5968E+05	1.1758E+03
1.8518E-01	1	10	-4.5782E+05	6.5470E+02
1.8518E-01	2	1	-9.5416E+05	3.1108E+03
1.8518E-01	2	2	-1.2452E+06	-8.1206E+02
1.8518E-01	2	3	-3.5977E+05	1.0213E+03
1.8518E-01	2	4	-3.1060E+05	5.8789E+02
1.8518E-01	2	5	-2.6339E+05	1.7535E+02
1.8518E-01	2	6	-9.6452E+05	1.8072E+03
1.8518E-01	2	7	-9.9252E+05	1.1954E+03
1.8518E-01	2	8	-6.9230E+05	5.3981E+02
1.8518E-01	2	9	-4.6102E+05	2.0711E+02
1.8518E-01	2	10	-3.1943E+05	4.8926E+01

TIME HISTORY INTERFACE LOADS FOR B2Z1T2 /CRE3

TIME	XHUB1000	ZHUB1000	ALFX1000	ALFY1000
0.0000E+00	-3.8484E+02	-5.0256E+03	-3.3217E+02	-4.2121E+04
1.8518E-02	-2.0448E+02	-6.6279E+03	1.4967E+05	-1.9945E+05
3.7037E-02	-9.8537E+01	-6.7554E+03	5.5958E+05	-2.1192E+05
5.5555E-02	9.0509E+02	-5.3629E+03	7.6950E+05	1.7080E+05

MORE...

7.4074E-02	4.9317E+02	-5.1494E+03	3.0659E+05	3.9905E+05
9.2592E-02	-4.7244E+02	-6.0990E+03	2.8526E+03	2.0407E+05
1.1111E-01	6.6871E+01	-7.2786E+03	-1.0685E+04	-4.4256E+02
1.2963E-01	-3.1652E+02	-6.6784E+03	4.1400E+05	-1.8967E+05
1.4815E-01	1.3732E+03	-4.8052E+03	6.4456E+05	1.5825E+05
1.6666E-01	1.1996E+02	-4.8682E+03	1.6361E+05	2.2717E+05
1.8518E-01	-4.8618E+02	-6.0860E+03	7.0480E+03	2.8157E+04

****

COMMAND

2.4.8 <u>SFD1 - Frequency Domain, Mobility</u>. A solution is performed for the ground resonance model discussed in paragraph 2.4.6. Response degrees of freedom have been selected from system and component degrees of freedom. Forced degrees of freedom can only be selected from system degrees of freedom. Peaks in the magnitudes of the complex mobilities indicate resonance frequencies.

```
RUN
MODEL NAME (DATA SET)
LAT
LIST MODEL SUMMARY (Y OR N)
Y

************************        MODEL LAT        *********************

LATERAL GROUND RESONANCE MODEL

INDEX    COMP     NO.    DATA SET          FORCE   DATA SET

  1      CRR2      1     ROTLAT            NONE
  2      CFM2      1     FUSLAT            NONE
  3      CSF1            LMAIN             NONE
  4      CSF1            RMAIN             NONE
  5      CSF1            TAIL              NONE
  6      CLC1            CGEAR             NONE

*******************************************************************

                                                            MORE...
*******************************************************************
                           GLOBAL  VARIABLES

 NO INPUT REQUIRED
*******************************************************************



TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
*******************************************************************
DETAILS (Y OR N)
N
PRINT MATRICES (Y OR N)
N
*******************************************************************
SOLUTION OR N
SFD1
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


                                                            MORE...
```

```
SOLUTION SFD1. FREQUENCY DOMAIN MOBIL.

BEGIN INPUT
-----
F0          (REAL)
    STARTING FREQ
ENTER 1 REAL VALUE
?
10
-----
FE          (REAL)
    ENDING FREQ
ENTER 1 REAL VALUE
?
20
-----
FD          (REAL)
    INCREMENTAL FREQ
ENTER 1 REAL VALUE
?
2
-----
                                                                  MORE...
IOU         (INTEGER)
    OUTPUT UNITS TYPE
    1 = DISPLACEMENT/UNIT FORCE
    2 = ACCELERATION/UNIT FORCE (G/LB)
ENTER    1 INTEGER VALUE(S)
1
-----
IPL         (Y OR N)
    WRITE PLOT FILES
    (Y OR N)
ENTER 1 Y OR N VALUE
N
-----
RDOF       (MODEL DOFS CHOSEN )
    RESPONSE DOF
SYSTEM DOFS
    1 ZETA1100      2 ZETA1200      3 ZETA1300      4 ZETA1400
    5 YCG 1000      6 ROLL1000

ALL SYSTEM DOFS (Y OR N)
N
SELECT DOFS BY INDEXES
                                                                  MORE...
```

```
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
5 6 0
ANY COMPONENT DOFS (Y OR N)
Y

SET OF COMPONENTS
   1 ROTLAT  /CRR2
   2 FUSLAT  /CFM2
   3 LMAIN   /CSF1
   4 RMAIN   /CSF1
   5 TAIL    /CSF1
   6 CGEAR   /CLC1
SELECT COMPONENTS BY INDICES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
3 4 0
DOFS FOR COMPONENT LMAIN   /CSF1
    1 X   2000      2 Y   2000      3 Z   2000

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
                                                                MORE...
2 3 0
DOFS FOR COMPONENT RMAIN   /CSF1
    1 X   1000      2 Y   1000      3 Z   1000

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
2 3 0
-----
SDOF     (SYSTEM DOFS CHOSEN)
    FORCED DOF
SYSTEM DOFS
    1 ZETA1100     2 ZETA1200     3 ZETA1300     4 ZETA1400
    5 YCG 1000     6 ROLL1000

ALL SYSTEM DOFS (Y OR N)
N
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
5 6 0
*******************************************************************
                                                                MORE...
```

```
SOLUTION INPUT FOR SFD1.FREQUENCY DOMAIN MOBIL.

  1 FO        - STARTING FREQ         =  1.00000E+01
  2 FE        - ENDING FREQ           =  2.00000E+01
  3 FD        - INCREMENTAL FREQ      =  2.00000E+00
  4 IOU       - OUTPUT UNITS TYPE     =            1
  5 IPL       - WRITE PLOT FILES      =           NO
  6 RDOF      - (MODEL DOFS SELECTED) RESPONSE DOF
     SYSTEM DOFS SELECTED
          YCG 1000   ROLL1000
     COMPONENT LMAIN    /CSF1 DOFS
          Y   2000  Z   2000
     COMPONENT RMAIN    /CSF1 DOFS
          Y   1000  Z   1000
  7 SDOF      - (SYSTEM DOFS SELECTED) FORCED DOF
          YCG 1000   ROLL1000
*******************************************************************

RE-ENTER (Y OR N)
N

***************** SOLUTION SFD1 FOR MODEL LAT      *****************
                                                              MORE...
MODEL    - LATERAL GROUND RESONANCE MODEL
SOLUTION - FREQUENCY DOMAIN MOBIL.


                  FREQUENCY DOMAIN, DISPLACEMENT/UNIT FORCE


 FREQ HZ   1.0000E+01

               FORCED DOF

               YCG 1000     ROLL1000

               REAL

 RESPONSE DOF

 YCG 1000      -7.7074E-06  -2.4609E-08
 ROLL1000      -2.4609E-08  -1.8976E-09
 Y   2000      -9.5718E-06  -1.6837E-07
                                                              MORE...
```

Z	2000	1.6242E-06	1.2524E-07
Y	1000	-9.5718E-06	-1.6837E-07
Z	1000	-1.6242E-06	-1.2524E-07

IMAG

RESPONSE DOF

YCG	1000	-2.2208E-08	-1.7125E-09
ROLL	1000	-1.7125E-09	-1.3205E-10
Y	2000	-1.5194E-07	-1.1716E-08
Z	2000	1.1302E-07	8.7152E-09
Y	1000	-1.5194E-07	-1.1716E-08
Z	1000	-1.1302E-07	-8.7152E-09

FREQ HZ 1.2000E+01

FORCED DOF

YCG 1000 ROLL1000

MORE...

REAL

RESPONSE DOF

YCG	1000	-5.2293E-06	-1.4897E-08
ROLL	1000	-1.4897E-08	-1.2769E-09
Y	2000	-6.3579E-06	-1.1163E-07
Z	2000	9.8323E-07	8.4274E-08
Y	1000	-6.3579E-06	-1.1163E-07
Z	1000	-9.8323E-07	-8.4274E-08

IMAG

RESPONSE DOF

YCG	1000	-9.7497E-09	-8.3567E-10
ROLL	1000	-8.3567E-10	-7.1627E-11
Y	2000	-7.3060E-08	-6.2621E-09
Z	2000	5.5154E-08	4.7274E-09
Y	1000	-7.3060E-08	-6.2621E-09
Z	1000	-5.5154E-08	-4.7274E-09

MORE...

FREQ HZ   1.4000E+01

FORCED DOF

YCG 1000   ROLL1000

REAL

RESPONSE DOF

YCG 1000	-3.7911E-06	-1.0042E-08
ROLL1000	-1.0042E-08	-9.2121E-10
Y 2000	-4.5519E-06	-7.9832E-08
Z 2000	6.6275E-07	6.0800E-08
Y 1000	-4.5519E-06	-7.9832E-08
Z 1000	-6.6275E-07	-6.0800E-08

IMAG

RESPONSE DOF

MORE...

YCG 1000	-5.1633E-09	-4.7368E-10
ROLL1000	-4.7368E-10	-4.3455E-11
Y 2000	-4.1049E-08	-3.7658E-09
Z 2000	3.1263E-08	2.8680E-09
Y 1000	-4.1049E-08	-3.7658E-09
Z 1000	-3.1263E-08	-2.8680E-09

FREQ HZ   1.6000E+01

FORCED DOF

YCG 1000   ROLL1000

REAL

RESPONSE DOF

YCG 1000	-2.8784E-06	-7.2584E-09
ROLL1000	-7.2584E-09	-6.9724E-10
Y 2000	-3.4283E-06	-6.0081E-08
Z 2000	4.7905E-07	4.6018E-08

MORE...

```
Y    1000     -3.4283E-06   -6.0081E-08
Z    1000     -4.7905E-07   -4.6018E-08

              IMAG

RESPONSE DOF

YCG 1000      -3.0814E-09   -2.9600E-10
ROLL1000      -2.9600E-10   -2.8434E-11
Y    2000     -2.5506E-08   -2.4501E-09
Z    2000      1.9536E-08    1.8766E-09
Y    1000     -2.5506E-08   -2.4501E-09
Z    1000     -1.9536E-08   -1.8766E-09


FREQ HZ    1.8000E+01

              FORCED DOF

              YCG 1000      ROLL1000

              REAL
                                                    MORE...

RESPONSE DOF

YCG 1000      -2.2615E-06   -5.5087E-09
ROLL1000      -5.5087E-09   -5.4665E-10
Y    2000     -2.6789E-06   -4.6923E-08
Z    2000      3.6358E-07    3.6079E-08
Y    1000     -2.6789E-06   -4.6923E-08
Z    1000     -3.6358E-07   -3.6079E-08

              IMAG

RESPONSE DOF

YCG 1000      -1.9960E-09   -1.9807E-10
ROLL1000      -1.9807E-10   -1.9656E-11
Y    2000     -1.7002E-08   -1.6872E-09
Z    2000      1.3073E-08    1.2973E-09
Y    1000     -1.7002E-08   -1.6872E-09
Z    1000     -1.3073E-08   -1.2973E-09


                                                    MORE...
```

```
FREQ HZ    2.0000E+01

              FORCED DOF

              YCG 1000       ROLL1000

              REAL

RESPONSE DOF

YCG 1000      -1.8246E-06   -4.3335E-09
ROLL1000      -4.3335E-09   -4.4037E-10
Y    2000     -2.1529E-06   -3.7696E-08
Z    2000      2.8601E-07    2.9065E-08
Y    1000     -2.1529E-06   -3.7696E-08
Z    1000     -2.8601E-07   -2.9065E-08

              IMAG

RESPONSE DOF

YCG 1000      -1.3721E-09   -1.3943E-10
                                                      MORE...
ROLL1000      -1.3943E-10   -1.4169E-11
Y    2000     -1.1936E-08   -1.2129E-09
Z    2000      9.2027E-09    9.3517E-10
Y    1000     -1.1936E-08   -1.2129E-09
Z    1000     -9.2027E-09   -9.3517E-10


      ***  FREQUENCY DOMAIN SOLUTION COMPLETE***
**********************************************************************
COMMAND
```

2.5 PLOT FILES

A plot file is a permanent, sequential file currently used to store time history solutions (displacement, velocity), time history interface loads, or frequency domain mobilities. The data is stored in a standardized format and can be post-processed for plotting or other purposes by external user-supplied routines. If the user attempts to save data without having assigned a plot file, a warning message will be printed, but normal execution will continue. Data from different RUNs can be added to a file during a DYSCO session, but a previously assigned file will be overwritten.

Currently, there are two plot file classifications - time history and frequency domain. Time history data includes output from STH3, STH4, STR3, and SII3, and frequency domain data is output from SFD1.

2.5.1 Time History Plot Files. Time history plot files can be one of three types:

a. Time history displacements

b. Time history velocities or interface loads

c. Time history displacements and velocities.

The data associated with each of the file types and the FORTRAN format statements used to write the data are shown below.

2.5.1.1 Time History Plot File Format -

Displacements (Type 1)

no. of dof/dof name 1/dof name 2/ ... /dof name n
[FORMAT (1X,I4,5(2X,A4,I4)/' ',(4X,5(2X,A4,I4)))]

file type
[FORMAT(1X,I4)]

no. of time increments/start time/end time/max displacement/min displacement
[FORMAT(1X,I4,1P4E13.4)]

$time_1$/$displacement_1$[dof_1]

.

.

.

$time_1$/$displacement_1$[dof_n]
$time_2$/$displacement_2$[dof_1]

.

.

.

$time_2$/$displacement_2$[dof_n]

.

.

.

$time_n$/$displacement_n$[$dof_{1,2,\ldots,n}$]
[FORMAT(1X,1P2E13.4)]

<u>Velocities or Interface Loads (Type 2)</u> -

component data set/data member [interface loads only]
[FORMAT(1X,2A4,1X,A4)]

no. of dof/dof name 1/dof name 2/ ... /dof name n
[FORMAT(1X,I4,5(2X,A4,I4)/' ',(4X,5(2X,A4,I4)))]

file type
[FORMAT(1X,I4)]

no. of time increments/start time/end time/max velocity/min velocity
/ max load / min load
[FORMAT(1X,I4,1P4E13.4)]

$time_1$/velocity(load)$_1$[dof$_1$]

.

.

.

$time_1$/velocity(load)$_1$[dof$_n$]
$time_2$/velocity(load)$_2$[dof$_1$]

.

.

.

$time_2$/velocity(load)$_2$[dof$_n$]

.

.

.

$time_n$/velocity(load)$_n$[dof$_{1,2,...,n}$]

<u>Displacements and Velocities (Type 3)</u> -

no. of dof/dof name 1/dof name 2/ ... /dof name n
[FORMAT(1X,I4,5(2X,A4,I4)/' ',(4X,5(2X,A4,I4)))]

file type
[FORMAT(1X,I4)]

no. of time increments/start time/end time/max displacement/min displacement
max velocity/min velocity
[FORMAT(1X,I4,1P4E13.4/5X,1P2E13.4)]

$time_1/displacement_1[dof_1]$

.

.

.

$time_1/displacement_1[dof_n]$
$time_1/velocity_1[dof_1]$

.

.

.

$time_1/velocity_1[dof_n]$
$time_2/displacement_2[dof_1]$

.

.

.

$time_2/displacement_2[dof_n]$
$time_2/velocity_2[dof_1]$

.

.

.

$time_2/velocity_2[dof_n]$

.

.

.

$time_n/displacement_n[dof_{1,2,\ldots,n}]$
$time_n/velocity_n[dof_{1,2,\ldots,n}]$
[Format(1X,1P2E13.4)]

2.5.1.2 Sample Time History Plot Files - The time history solution for the ground resonance model, shown in paragraph 2.4.6, is repeated below. The solution has actually been run three times to generate examples of the three types of time history plot files. These follow the solution. The displacements and velocities have been output in the solution shown and can be compared with the data in the plot files. Note, only data for every other time increment has been written to the plot files and the loads file.

In addition, the time history interface loads have been computed from the saved time history solution state vectors and have been written to a plot file. The loads solution and plot file are also shown.

```
RUN
MODEL NAME (DATA SET)
LAT
LIST MODEL SUMMARY (Y OR N)
Y

************************      MODEL LAT      ************************

LATERAL GROUND RESONANCE MODEL

INDEX   COMP    NO.   DATA SET        FORCE   DATA SET

  1     CRR2     1    ROTLAT          NONE
  2     CFM2     1    FUSLAT          NONE
  3     CSF1          LMAIN           NONE
  4     CSF1          RMAIN           NONE
  5     CSF1          TAIL            NONE
  6     CLC1          CGEAR           NONE

**********************************************************************

                                                              MORE...
**********************************************************************
                          GLOBAL  VARIABLES

 NO INPUT REQUIRED
**********************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
*******************************************************************
DETAILS (Y OR N)
Y


 ********************************************************************
                   COMPONENT DOF/SYSTEM DOF
                1, 6         2, 7        3, 8        4, 9        5, 10

  1  CRR2     ZETA1100    ZETA1200    ZETA1300    ZETA1400    YHUB1000
              ALFX1000
                                                              MORE...
```

```
            (    1)        (    2)        (    3)        (    4)        (   -1)
            (   -3)

  2  CFM2     YCG 1000     ROLL1000
              (    5)      (    6)

  3  CSF1     X    2000    Y    2000      Z    2000
              (    0)      (   -4)        (   -6)

  4  CSF1     X    1000    Y    1000      Z    1000
              (    0)      (   -7)        (   -9)

  5  CSF1     X    3000    Y    3000      Z    3000
              (    0)      (  -10)        (    0)

  6  CLC1     YCG 1000     ROLL1000
              (    5)      (    6)


          SYSTEM DOF

          1     ZETA1100
                                                            MORE...
          2     ZETA1200
          3     ZETA1300
          4     ZETA1400
          5     YCG 1000
          6     ROLL1000


                  IMPLICIT COEFFICIENTS

     I       COEF           DOF          I      COEF           DOF

     1    9.976E-01     YCG 1000         7    1.000E+00      YCG 1000
     2   -8.403E+01    *ROLL1000         8    7.576E+01     *ROLL1000
     3    9.945E-01    *ROLL1000         9    6.600E+01     *ROLL1000
     4    1.000E+00     YCG 1000        10    1.000E+00      YCG 1000
     5    7.576E+01    *ROLL1000        11    7.576E+01     *ROLL1000
     6   -6.600E+01    *ROLL1000
PRINT MATRICES (Y OR N)
N
**************************************************************************
SOLUTION OR N
STH4
                                                            MORE...
```

```
SAVE CASE FOR LATER EXECUTION (Y OR N)
N

SOLUTION STH4. TIME HISTORY

BEGIN INPUT
-----
TSTA      (REAL)
    START TIME
    (SEC)
ENTER 1 REAL VALUE
?
0
-----
H         (REAL)
    INITIAL INCREMENT
    (SEC)
ENTER 1 REAL VALUE
?
.0096962
-----
                                                        MORE...
HTD       (REAL)
    SEPARATE INCREMENT
    TIME DEP COEFS
ENTER 1 REAL VALUE
?
0
-----
HF        (REAL)
    SEPARATE INCREMENT
    FORCE COMPUTATION
ENTER 1 REAL VALUE
?
0
-----
TEND      (REAL)
    END TIME
    (SEC)
ENTER 1 REAL VALUE
?
.096962
-----
E         (REAL)
                                                        MORE...
```

```
    ERROR CHECK VALUE
    IF 0 THEN CONSTANT INCREMENT USED
ENTER 1 REAL VALUE
?
.0001
-----
IDFLI    (SYSTEM DOFS CHOSEN)
    TEST DOF
    NAME  (A4,I4)
SYSTEM DOFS
    1 ZETA1100     2 ZETA1200     3 ZETA1300     4 ZETA1400
    5 YCG 1000     6 ROLL1000

SELECT ONE SYSTEM DOF BY INDEX
1
-----
ICOPT     (INTEGER)
    INITIAL CONDITION
    INPUT TYPE
    0=NONE, 1=SINGLE DISPLACEMENT, 2=GENERAL, 3=CONTINUE
ENTER     1 INTEGER VALUE(S)
1
                                                                 MORE...
-----
VI        (REAL)
    INITIAL DISPLACEMENT
    SINGLE SYSTEM DOF (IN OR RAD)
ENTER 1 REAL VALUE
?
.1
-----
IIDFLI    (SYSTEM DOFS CHOSEN)
    DOF NAME
    INITIAL CONDITION
SYSTEM DOFS
    1 ZETA1100     2 ZETA1200     3 ZETA1300     4 ZETA1400
    5 YCG 1000     6 ROLL1000

SELECT ONE SYSTEM DOF BY INDEX
1
-----
CRT       (Y OR N)
    OUTPUT THIS TERMINAL
    (Y OR N)
ENTER 1 Y OR N VALUE
                                                                 MORE...
```

```
Y
-----
PROP     (INTEGER)
    PRINT
    1=DISPLACEMENT 2=VELOCITY 3=BOTH
ENTER    1 INTEGER VALUE(S)
3
-----
DOFPRINT (MODEL DOFS CHOSEN )
    DOFS TO BE PRINTED
SYSTEM DOFS
    1 ZETA1100      2 ZETA1200      3 ZETA1300      4 ZETA1400
    5 YCG 1000      6 ROLL1000

ALL SYSTEM DOFS (Y OR N)
N
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
1 5 6 0
ANY COMPONENT DOFS (Y OR N)
Y

                                                              MORE...
SET OF COMPONENTS
   1 ROTLAT   /CRR2
   2 FUSLAT   /CFM2
   3 LMAIN    /CSF1
   4 RMAIN    /CSF1
   5 TAIL     /CSF1
   6 CGEAR    /CLC1
SELECT COMPONENTS BY INDICES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
3 0
DOFS FOR COMPONENT LMAIN   /CSF1
    1 X   2000     2 Y   2000     3 Z   2000

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
2 3 0
-----
PLOP     (INTEGER)
    PLOT
    0=NONE 1=DISPLACEMENT 2=VELOCITY 3=BOTH
                                                              MORE...
```

```
ENTER    1 INTEGER VALUE(S)
3
-----
JPLT      (INTEGER)
    INPUT N, EVERY NTH
    SOLUTION TO BE WRITTEN TO PLOT FILE
ENTER    1 INTEGER VALUE(S)
2
-----
DOFPLOT  (MODEL DOFS CHOSEN )
    DOFS TO BE PLOTTED
SYSTEM DOFS
    1 ZETA1100      2 ZETA1200      3 ZETA1300      4 ZETA1400
    5 YCG 1000      6 ROLL1000

ALL SYSTEM DOFS (Y OR N)
N
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
1 5 6 0
ANY COMPONENT DOFS (Y OR N)
Y
                                                                MORE...

SET OF COMPONENTS
   1 ROTLAT   /CRR2
   2 FUSLAT   /CFM2
   3 LMAIN    /CSF1
   4 RMAIN    /CSF1
   5 TAIL     /CSF1
   6 CGEAR    /CLC1
SELECT COMPONENTS BY INDICES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
3 0
DOFS FOR COMPONENT LMAIN   /CSF1
    1 X   2000      2 Y   2000      3 Z   2000

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
2 3 0
-----
FLOP      (Y OR N)
    CONDITION CODES
                                                                MORE...
```

```
   TO BE OUTPUT (Y OR N)
ENTER 1 Y OR N VALUE
N
------
ILOP      (Y OR N)
   SAVE STATE VECTORS
   FOR INTERFACE, INTERNAL LOADS CALCULATIONS
ENTER 1 Y OR N VALUE
Y
------
JIIL      (INTEGER)
   INPUT I, EVERY ITH
   STATE VECTOR TO BE WRITTEN TO LOADS FILE
ENTER     1 INTEGER VALUE(S)
2
*********************************************************************
SOLUTION INPUT FOR STH4.TIME HISTORY

  1 TSTA       - START TIME            =  0.00000E+00
  2 H          - INITIAL INCREMENT     =  9.69620E-03
  3 HTD        - SEPARATE INCREMENT    =  0.00000E+00
  4 HF         - SEPARATE INCREMENT    =  0.00000E+00
                                                          MORE...
  5 TEND       - END TIME              =  9.69620E-02
  6 E          - ERROR CHECK VALUE     =  1.00000E-04
  7 IDFLI      - (SYSTEM DOF SELECTED)
                 TEST DOF               = ZETA1100
  8 ICOPT      - INITIAL CONDITION     =             1
  9 VI         - INITIAL DISPLACEMENT=  1.00000E-01
 10 IIDFLI     - (SYSTEM DOF SELECTED)
                 DOF NAME               = ZETA1100
 11 CRT        - OUTPUT THIS TERMINAL=             YES
 12 PROP       - PRINT                 =             3
 13 DOFPRINT - (MODEL DOFS SELECTED) DOFS TO BE PRINTED
     SYSTEM DOFS SELECTED
          ZETA1100  YCG 1000  ROLL1000
    COMPONENT LMAIN    /CSF1 DOFS
          Y    2000  Z   2000
 14 PLOP       - PLOT                  =             3
 15 JPLT       - INPUT N, EVERY NTH    =             2
 16 DOFPLOT    - (MODEL DOFS SELECTED) DOFS TO BE PLOTTED
     SYSTEM DOFS SELECTED
          ZETA1100  YCG 1000  ROLL1000
    COMPONENT LMAIN    /CSF1 DOFS
          Y    2000  Z   2000
                                                          MORE...
```

```
 17 FLOP       - CONDITION CODES      =          NO
 18 ILOP       - SAVE STATE VECTORS   =          YES
 19 JIIL       - INPUT I, EVERY ITH   =             2
********************************************************************************

RE-ENTER (Y OR N)
N

**************** SOLUTION STH4 FOR MODEL LAT       *****************
MODEL    - LATERAL GROUND RESONANCE MODEL
SOLUTION - TIME HISTORY


                    TIME HISTORY DISPLACEMENTS AND VELOCITIES

 TIME               ZETA1100         YCG 1000         ROLL1000          Y   2000
                    Z   2000
  0.0000E+00         1.0000E-01       0.0000E+00       0.0000E+00        0.0000E+00
                     0.0000E+00
  0.0000E+00         0.0000E+00       0.0000E+00       0.0000E+00        0.0000E+00
                     0.0000E+00
                                                                        MORE...
  9.6962E-03         9.9431E-02       1.0035E-02      -2.1703E-04       -6.4080E-03
                     1.4324E-02
  9.6962E-03        -1.1591E-01       2.0464E+00      -4.3810E-02       -1.2727E+00
                     2.8915E+00
  1.9392E-02         9.7790E-02       3.8781E-02      -8.1975E-04       -2.3323E-02
                     5.4103E-02
  1.9392E-02        -2.2019E-01       3.8152E+00      -7.8469E-02       -2.1296E+00
                     5.1790E+00
  2.9089E-02         9.5212E-02       8.2355E-02      -1.6911E-03       -4.5763E-02
                     1.1161E-01
  2.9089E-02        -3.0910E-01       5.0723E+00      -9.8517E-02       -2.3914E+00
                     6.5021E+00
  3.8785E-02         9.1841E-02       1.3500E-01      -2.6734E-03       -6.7540E-02
                     1.7645E-01
  3.8785E-02        -3.8427E-01       5.6703E+00      -1.0115E-01       -1.9926E+00
                     6.6758E+00
  4.8481E-02         8.7786E-02       1.9005E-01      -3.5966E-03       -8.2435E-02
                     2.3738E-01
  4.8481E-02        -4.5136E-01       5.5708E+00      -8.6615E-02       -9.9121E-01
                     5.7166E+00
  5.8177E-02         8.3093E-02       2.4099E-01      -4.3075E-03       -8.5342E-02
                     2.8429E-01

                                                                        MORE...
```

```
 5.8177E-02     -5.1672E-01      4.8449E+00     -5.8083E-02      4.4452E-01
                 3.8335E+00
 6.7873E-02      7.7759E-02      2.8250E-01     -4.6950E-03     -7.3198E-02
                 3.0987E-01
 6.7873E-02     -5.8388E-01      3.6566E+00     -2.0969E-02      2.0680E+00
                 1.3840E+00
 7.7569E-02      7.1767E-02      3.1113E-01     -4.7078E-03     -4.5535E-02
                 3.1072E-01
 7.7569E-02     -6.5177E-01      2.2296E+00      1.8081E-02      3.5995E+00
                -1.1934E+00
 8.7265E-02      4.5133E-02      3.2575E-01     -4.3598E-03     -4.5525E-03
                 2.8775E-01
 8.7265E-02     -7.1523E-01      8.0495E-01      5.2412E-02      4.7757E+00
                -3.4592E+00
 9.6962E-02      5.7932E-02      3.2745E-01     -3.7248E-03      4.5261E-02
                 2.4584E-01
 9.6962E-02     -7.6777E-01     -4.0198E-01      7.6517E-02      5.3949E+00
                -5.0501E+00
 9.6962E-02      5.7932E-02      3.2745E-01     -3.7248E-03      4.5262E-02
                 2.4583E-01
 9.6962E-02     -7.6777E-01     -4.0200E-01      7.6517E-02      5.3949E+00
                -5.0501E+00
                                                                MORE...
 9.6962E-02      5.7932E-02      3.2745E-01     -3.7248E-03      4.5263E-02
                 2.4583E-01
 9.6962E-02     -7.6777E-01     -4.0202E-01      7.6517E-02      5.3949E+00
                -5.0501E+00


          *** TIME HISTORY SOLUTION TERMINATED AT    0.09696   SECONDS ***

SYSTEM STATE VECTOR AT T =  9.69619E-02

      DOF       VELOCITY     DISPLACEMENT

    ZETA1100   -7.67767E-01    5.79319E-02
    ZETA1200   -4.81731E-02   -2.67860E-04
    ZETA1300    1.00143E-01    5.75292E-03
    ZETA1400    4.81731E-02    2.67864E-04
    YCG 1000   -4.02019E-01    3.27450E-01
    ROLL1000    7.65170E-02   -3.72476E-03
***************************************************************************
COMMAND
```

```
LATD FLT1 A

5  ZETA1100  YCG 1000 .ROLL1000  Y   2000  Z   2000

1
7   0.0000E+00   9.6962E-02   3.2745E-01   -8.5342E-02
0.0000E+00   1.0000E-01
0.0000E+00   0.0000E+00
0.0000E+00   0.0000E+00
0.0000E+00   0.0000E+00
0.0000E+00   0.0000E+00
1.9392E-02   9.7790E-02
1.9392E-02   3.8781E-02
1.9392E-02  -8.1975E-04
1.9392E-02  -2.3323E-02
1.9392E-02   5.4103E-02
3.8785E-02   9.1841E-02
3.8785E-02   1.3500E-01
3.8785E-02  -2.6734E-03
3.8785E-02  -6.7540E-02
3.8785E-02   1.7645E-01
5.8177E-02   8.3093E-02
                                                   MORE...
5.8177E-02   2.4099E-01
5.8177E-02  -4.3075E-03
5.8177E-02  -8.5342E-02
5.8177E-02   2.8429E-01
7.7569E-02   7.1767E-02
7.7569E-02   3.1113E-01
7.7569E-02  -4.7078E-03
7.7569E-02  -4.5535E-02
7.7569E-02   3.1072E-01
9.6962E-02   5.7932E-02
9.6962E-02   3.2745E-01
9.6962E-02  -3.7248E-03
9.6962E-02   4.5261E-02
9.6962E-02   2.4584E-01
9.6962E-02   5.7932E-02
9.6962E-02   3.2745E-01
9.6962E-02  -3.7248E-03
9.6962E-02   4.5263E-02
9.6962E-02   2.4583E-01
```

LATV PLT1 A

5 ZETA1100 YCG 1000 ROLL1000 Y 2000 Z 2000

2

7	0.0000E+00	9.6962E-02	6.6758E+00	-5.0501E+00

0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00
1.9392E-02	-2.2019E-01
1.9392E-02	3.8152E+00
1.9392E-02	-7.8469E-02
1.9392E-02	-2.1296E+00
1.9392E-02	5.1790E+00
3.8785E-02	-3.8427E-01
3.8785E-02	5.6703E+00
3.8785E-02	-1.0115E-01
3.8785E-02	-1.9926E+00
3.8785E-02	6.6758E+00
5.8177E-02	-5.1672E-01

MORE...

5.8177E-02	4.8449E+00
5.8177E-02	-5.8083E-02
5.8177E-02	4.4452E-01
5.8177E-02	3.8335E+00
7.7569E-02	-6.5177E-01
7.7569E-02	2.2296E+00
7.7569E-02	1.8081E-02
7.7569E-02	3.5995E+00
7.7569E-02	-1.1934E+00
9.6962E-02	-7.6777E-01
9.6962E-02	-4.0198E-01
9.6962E-02	7.6517E-02
9.6962E-02	5.3949E+00
9.6962E-02	-5.0501E+00
9.6962E-02	-7.6777E-01
9.6962E-02	-4.0202E-01
9.6962E-02	7.6517E-02
9.6962E-02	5.3949E+00
9.6962E-02	-5.0501E+00

```
 LATDV PLT1 A

5  ZETA1100   YCG 1000   ROLL1000   Y    2000   Z    2000

3
7   0.0000E+00    9.6962E-02    3.2745E-01   -8.5342E-02
    6.6758E+00   -5.0501E+00
0.0000E+00    1.0000E-01
0.0000E+00    0.0000E+00
0.0000E+00    0.0000E+00
0.0000E+00    0.0000E+00
0.0000E+00    0.0000E+00
0.0000E+00    0.0000E+00
0.0000E+00    0.0000E+00
0.0000E+00    0.0000E+00
0.0000E+00    0.0000E+00
0.0000E+00    0.0000E+00
1.9392E-02    9.7790E-02
1.9392E-02    3.8781E-02
1.9392E-02   -8.1975E-04
1.9392E-02   -2.3323E-02
1.9392E-02    5.4103E-02
                                                       MORE...
1.9392E-02   -2.2019E-01
1.9392E-02    3.8152E+00
1.9392E-02   -7.8469E-02
1.9392E-02   -2.1296E+00
1.9392E-02    5.1790E+00
3.8785E-02    9.1841E-02
3.8785E-02    1.3500E-01
3.8785E-02   -2.6734E-03
3.8785E-02   -6.7540E-02
3.8785E-02    1.7645E-01
3.8785E-02   -3.8427E-01
3.8785E-02    5.6703E+00
3.8785E-02   -1.0115E-01
3.8785E-02   -1.9926E+00
3.8785E-02    6.6758E+00
5.8177E-02    8.3093E-02
5.8177E-02    2.4099E-01
5.8177E-02   -4.3075E-03
5.8177E-02   -8.5342E-02
5.8177E-02    2.8429E-01
5.8177E-02   -5.1672E-01
5.8177E-02    4.8449E+00
                                                       MORE...
```

5.8177E-02	-5.8083E-02
5.8177E-02	4.4452E-01
5.8177E-02	3.8335E+00
7.7569E-02	7.1767E-02
7.7569E-02	3.1113E-01
7.7569E-02	-4.7078E-03
7.7569E-02	-4.5535E-02
7.7569E-02	3.1072E-01
7.7569E-02	-6.5177E-01
7.7569E-02	2.2296E+00
7.7569E-02	1.8081E-02
7.7569E-02	3.5995E+00
7.7569E-02	-1.1934E+00
9.6962E-02	5.7932E-02
9.6962E-02	3.2745E-01
9.6962E-02	-3.7248E-03
9.6962E-02	4.5261E-02
9.6962E-02	2.4584E-01
9.6962E-02	-7.6777E-01
9.6962E-02	-4.0198E-01
9.6962E-02	7.6517E-02
9.6962E-02	5.3949E+00

MORE...

9.6962E-02	-5.0501E+00
9.6962E-02	5.7932E-02
9.6962E-02	3.2745E-01
9.6962E-02	-3.7248E-03
9.6962E-02	4.5263E-02
9.6962E-02	2.4583E-01
9.6962E-02	-7.6777E-01
9.6962E-02	-4.0202E-01
9.6962E-02	7.6517E-02
9.6962E-02	5.3949E+00
9.6962E-02	-5.0501E+00

```
RERUN
RERUNNING MODEL LAT
*******************************************************************
DETAILS (Y OR N)
N
PRINT MATRICES (Y OR N)
N
*******************************************************************
SOLUTION OR N
SII3
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION SII3. TIME HISTORY LOADS

BEGIN INPUT
-----
IFL        (Y OR N)
    INTERFACE LOADS
    OPTION
ENTER 1 Y OR N VALUE
                                                            MORE...
Y
-----
IFLDF      (COMPONENT DOFS )
    INTERFACE DOF
    SELECT ONLY ONE COMPONENT

SET OF COMPONENTS
   1 ROTLAT   /CRR2
   2 FUSLAT   /CFM2
   3 LMAIN    /CSF1
   4 RMAIN    /CSF1
   5 TAIL     /CSF1
   6 CGEAR    /CLC1
SELECT COMPONENTS BY INDICES
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
3 0
DOFS FOR COMPONENT LMAIN    /CSF1
    1 X    2000      2 Y    2000      3 Z    2000

SELECT DOF INDEXES (Y OR N) OR QUIT COMPONENTS (Q)
Y
SELECT DOFS BY INDEXES  .
                                                            MORE...
```

```
ENTER UNIQUE INTEGER VALUES - TO TERMINATE ENTER        0
2 3 0
-----
IFLPL     (Y OR N)
    PLOT INTERFACE LOADS
ENTER 1 Y OR N VALUE
Y
-----
INL       (Y OR N)
    INTERNAL LOADS
    OPTION
ENTER 1 Y OR N VALUE
N
*******************************************************************
SOLUTION INPUT FOR SII3.TIME HISTORY LOADS

  1 IFL       - INTERFACE LOADS      =        YES
  2 IFLDF     - (COMPONENT DOFS SELECTED) INTERFACE DOF
     COMPONENT LMAIN   /CSF1 DOFS
          Y    2000  Z   2000
  3 IFLPL     - PLOT INTERFACE LOADS=        YES
  4 INL       - INTERNAL LOADS       =        NO
                                                             MORE...
********************************************************************

RE-ENTER (Y OR N)
N

***************** SOLUTION SII3 FOR MODEL LAT      *****************
MODEL    - LATERAL GROUND RESONANCE MODEL
SOLUTION - TIME HISTORY LOADS


WARNING:

SOLUTION NOT VALID IF TEMP EDIT WAS USED WITH TIME
HISTORY RUN OR WITH THIS SOLUTION

SOLUTION NOT VALID IF SEPARATE TIME INCREMENTS
(HTD,HF) HAVE BEEN USED IN TIME HISTORY RUN

                      TIME HISTORY INTERFACE LOADS FOR LMAIN   /CSF1

                                                             MORE...
```

TIME	Y 2000	Z 2000
0.0000E+00	0.0000E+00	0.0000E+00
1.9392E-02	-6.9149E+01	3.8757E+02
3.8785E-02	-2.0025E+02	5.8298E+02
5.8177E-02	-2.5302E+02	4.7777E+02
7.7569E-02	-1.3500E+02	1.6329E+02
9.6962E-02	1.3419E+02	-1.4455E+02
9.6962E-02	1.3420E+02	-1.4455E+02

****

COMMAND

```
    LATL PLT1 A

LMAIN     CSF1
   2  Y   2000  Z   2000
   2
   7   0.0000E+00   9.6962E-02   5.8298E+02  -2.5302E+02
   0.0000E+00   0.0000E+00
   0.0000E+00   0.0000E+00
   1.9392E-02  -6.9149E+01
   1.9392E-02   3.8757E+02
   3.8785E-02  -2.0025E+02
   3.8785E-02   5.8298E+02
   5.8177E-02  -2.5302E+02
   5.8177E-02   4.7777E+02
   7.7569E-02  -1.3500E+02
   7.7569E-02   1.6329E+02
   9.6962E-02   1.3419E+02
   9.6962E-02  -1.4455E+02
   9.6962E-02   1.3420E+02
   9.6962E-02  -1.4455E+02
```

2.5.2 <u>Frequency Domain Plot Files</u>. Frequency domain plot files can be one of two types:

a. Real mobilities

b. Complex mobilities.

The data associated with each of the file types and the FORTRAN format statements used to write the data are shown below.

2.5.2.1 <u>Frequency Domain Plot File Format</u>

<u>Real Mobilities (Type 1)</u>

no. of forced dof/dof name 1/dof name 2/ ... /dof name n
no. of response dof/dof name 1/dof name 2/ ... /dof name n
[FORMAT(1X,I4,5(2X,A4,I4)/' ',(4X,5(2X,A4,I4)))]

file type
[FORMAT(1X,I4)]

no. of frequency increments/start freq/end freq/max real mobil/min real mobil
[FORMAT(1X,I4,1P4E13.4)]

$freq_1$/real $mobil_1$[forced dof_1, response dof_1]

.

.

.

$freq_1$/real $mobil_1$[forced dof_1, response dof_n]
$freq_1$/real $mobil_1$[forced dof_2, response dof_1]

.

.

.

$freq_1$/real $mobil_1$[forced dof_2, response dof_n]

.

.

.

$freq_1$/real $mobil_1$[forced dof_n, response $dof_{1,2,\ldots,n}$]

.

.

.

$freq_n$/real $mobil_n$[forced $dof_{1,2,\ldots,n}$, response $dof_{1,2,\ldots,n}$]

Complex Mobilities (Type 2) -

no. of response dof/dof name 1/dof name 2/ ... /dof name n
no. of forced dof/dof name 1/dof name 2/ ... /dof name n
[FORMAT(1X,I4,5(2X,A4,I4)/' ',(4X,5(2X,A4,I4)))]

file type
[FORMAT(1X,I4)]

no. of frequency increments/start freq/end freq/max real mobil/min real mobil
max imag mobil/min imag mobil
[FORMAT(1X,I4,1P4E13.4/5X,1P2E13.4)]

$freq_1$/real $mobil_1$[forced dof_1, response dof_1]

.

.

.

$freq_1$/real $mobil_1$[forced dof_1, response dof_n]
$freq_1$/real $mobil_1$[forced dof_2, response dof_1]

.

.

.

$freq_1$/real $mobil_1$[forced dof_2, response dof_n]

.

.

.

$freq_1$/real $mobil_1$[forced dof_n, response $dof_{1,2,...,n}$]
$freq_1$/imag $mobil_1$[forced dof_1, response dof_1]

.

.

.

$freq_1$/imag $mobil_1$[forced dof_1, response dof_n]
$freq_1$/imag $mobil_1$[forced dof_2, response dof_1]

.

.

.

$freq_1$/imag $mobil_1$[forced dof_2, response dof_n]

.

.

.

$freq_1$/imag $mobil_1$[forced dof_n, response $dof_{1,2,...,n}$]

.

.

.

$freq_n$/real $mobil_n$[forced $dof_{1,2,...,n}$, response $dof_{1,2,...,n}$]
$freq_n$/imag $mobil_n$[forced $dof_{1,2,...,n}$, response $dof_{1,2,...,n}$]

2.5.2.2 Sample Frequency Domain Plot Files - The mobilities for the frequency domain solution shown in paragraph 2.4.8 have been written to the plot file shown below.

```
EXS PLT1 A

2  YCG 1000  ROLL1000
6  YCG 1000  ROLL1000  Y   2000  Z   2000  Y   1000
   Z   1000
2
6   1.0000E+01   2.0000E+01   1.6242E-06  -9.5718E-06
    1.1302E-07  -1.5194E-07
1.0000E+01  -7.7074E-06
1.0000E+01  -2.4609E-08
1.0000E+01  -9.5718E-06
1.0000E+01   1.6242E-06
1.0000E+01  -9.5718E-06
1.0000E+01  -1.6242E-06
1.0000E+01  -2.4609E-08
1.0000E+01  -1.8976E-09
1.0000E+01  -1.6837E-07
1.0000E+01   1.2524E-07
1.0000E+01  -1.6837E-07
1.0000E+01  -1.2524E-07
1.0000E+01  -2.2208E-08
1.0000E+01  -1.7125E-09
                                                MORE...
1.0000E+01  -1.5194E-07
1.0000E+01   1.1302E-07
1.0000E+01  -1.5194E-07
1.0000E+01  -1.1302E-07
1.0000E+01  -1.7125E-09
1.0000E+01  -1.3205E-10
1.0000E+01  -1.1716E-08
1.0000E+01   8.7152E-09
1.0000E+01  -1.1716E-08
1.0000E+01  -8.7152E-09
1.2000E+01  -5.2293E-06
1.2000E+01  -1.4897E-08
1.2000E+01  -6.3579E-06
1.2000E+01   9.8323E-07
1.2000E+01  -6.3579E-06
1.2000E+01  -9.8323E-07
1.2000E+01  -1.4897E-08
1.2000E+01  -1.2769E-09
1.2000E+01  -1.1163E-07
1.2000E+01   8.4274E-08
1.2000E+01  -1.1163E-07
1.2000E+01  -8.4274E-08
                                                MORE...
```

1.2000E+01	-9.7497E-09
1.2000E+01	-8.3567E-10
1.2000E+01	-7.3060E-08
1.2000E+01	5.5154E-08
1.2000E+01	-7.3060E-08
1.2000E+01	-5.5154E-08
1.2000E+01	-8.3567E-10
1.2000E+01	-7.1627E-11
1.2000E+01	-6.2621E-09
1.2000E+01	4.7274E-09
1.2000E+01	-6.2621E-09
1.2000E+01	-4.7274E-09
1.4000E+01	-3.7911E-06
1.4000E+01	-1.0042E-08
1.4000E+01	-4.5519E-06
1.4000E+01	6.6275E-07
1.4000E+01	-4.5519E-06
1.4000E+01	-6.6275E-07
1.4000E+01	-1.0042E-08
1.4000E+01	-9.2121E-10
1.4000E+01	-7.9832E-08
1.4000E+01	6.0800E-08

MORE...

1.4000E+01	-7.9832E-08
1.4000E+01	-6.0800E-08
1.4000E+01	-5.1633E-09
1.4000E+01	-4.7368E-10
1.4000E+01	-4.1049E-08
1.4000E+01	3.1263E-08
1.4000E+01	-4.1049E-08
1.4000E+01	-3.1263E-08
1.4000E+01	-4.7368E-10
1.4000E+01	-4.3455E-11
1.4000E+01	-3.7658E-09
1.4000E+01	2.8680E-09
1.4000E+01	-3.7658E-09
1.4000E+01	-2.8680E-09
1.6000E+01	-2.8784E-06
1.6000E+01	-7.2584E-09
1.6000E+01	-3.4283E-06
1.6000E+01	4.7905E-07
1.6000E+01	-3.4283E-06
1.6000E+01	-4.7905E-07
1.6000E+01	-7.2584E-09
1.6000E+01	-6.9724E-10

MORE...

1.6000E+01	-6.0081E-08
1.6000E+01	4.6018E-08
1.6000E+01	-6.0081E-08
1.6000E+01	-4.6018E-08
1.6000E+01	-3.0814E-09
1.6000E+01	-2.9600E-10
1.6000E+01	-2.5506E-08
1.6000E+01	1.9536E-08
1.6000E+01	-2.5506E-08
1.6000E+01	-1.9536E-08
1.6000E+01	-2.9600E-10
1.6000E+01	-2.8434E-11
1.6000E+01	-2.4501E-09
1.6000E+01	1.8766E-09
1.6000E+01	-2.4501E-09
1.6000E+01	-1.8766E-09
1.8000E+01	-2.2615E-06
1.8000E+01	-5.5087E-09
1.8000E+01	-2.6789E-06
1.8000E+01	3.6358E-07
1.8000E+01	-2.6789E-06
1.8000E+01	-3.6358E-07

MORE...

1.8000E+01	-5.5087E-09
1.8000E+01	-5.4665E-10
1.8000E+01	-4.6923E-08
1.8000E+01	3.6079E-08
1.8000E+01	-4.6923E-08
1.8000E+01	-3.6079E-08
1.8000E+01	-1.9960E-09
1.8000E+01	-1.9807E-10
1.8000E+01	-1.7002E-08
1.8000E+01	1.3073E-08
1.8000E+01	-1.7002E-08
1.8000E+01	-1.3073E-08
1.8000E+01	-1.9807E-10
1.8000E+01	-1.9656E-11
1.8000E+01	-1.6872E-09
1.8000E+01	1.2973E-09
1.8000E+01	-1.6872E-09
1.8000E+01	-1.2973E-09
2.0000E+01	-1.8246E-06
2.0000E+01	-4.3335E-09
2.0000E+01	-2.1529E-06
2.0000E+01	2.8601E-07

MORE...

2.0000E+01	-2.1529E-06
2.0000E+01	-2.8601E-07
2.0000E+01	-4.3335E-09
2.0000E+01	-4.4037E-10
2.0000E+01	-3.7696E-08
2.0000E+01	2.9065E-08
2.0000E+01	-3.7696E-08
2.0000E+01	-2.9065E-08
2.0000E+01	-1.3721E-09
2.0000E+01	-1.3943E-10
2.0000E+01	-1.1936E-08
2.0000E+01	9.2027E-09
2.0000E+01	-1.1936E-08
2.0000E+01	-9.2027E-09
2.0000E+01	-1.3943E-10
2.0000E+01	-1.4169E-11
2.0000E+01	-1.2129E-09
2.0000E+01	9.3517E-10
2.0000E+01	-1.2129E-09
2.0000E+01	-9.3517E-10

2.6 MODELING EXAMPLES

2.6.1 PACOSS Tower. The PACOSS (Passive and Active Control of Space Structures) tower is a truss structure built for the Air Force Flight Dynamics Laboratory for the purpose of testing vibration suppression systems being developed for use with large space structures. The structure (Figure 12) is composed of aluminum and plexiglass tubing and is bolted to the floor in an upright position.

The tower is divided into three segments which are identical in geometry, but the middle segment is rotated 90° with respect to the other segments and its vertical members have thicker walls. Modeling strategy was to simulate a tower segment (Figure 13) using a finite element representation of the horizontal and diagonal members and a modal representation of the vertical members, then reduce the complex system to a simple representation with all of the properties of the complex system. This was accomplished by coupling the finite element and modal components and performing an eigenanalysis of the coupled system. A simple 3-D modal representation of the segment was then formulated from the eigensolution. This process was repeated for the middle segment, and the modal representations for all three segments were coupled together. Appropriate boundary conditions were then applied and an eigenanalysis of the complete coupled system was performed.

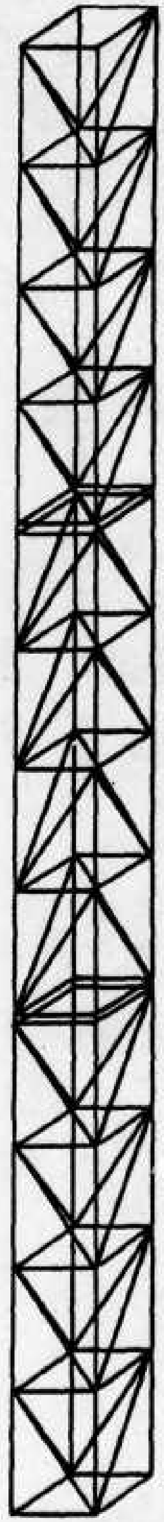

Figure 12. PACOSS Tower.

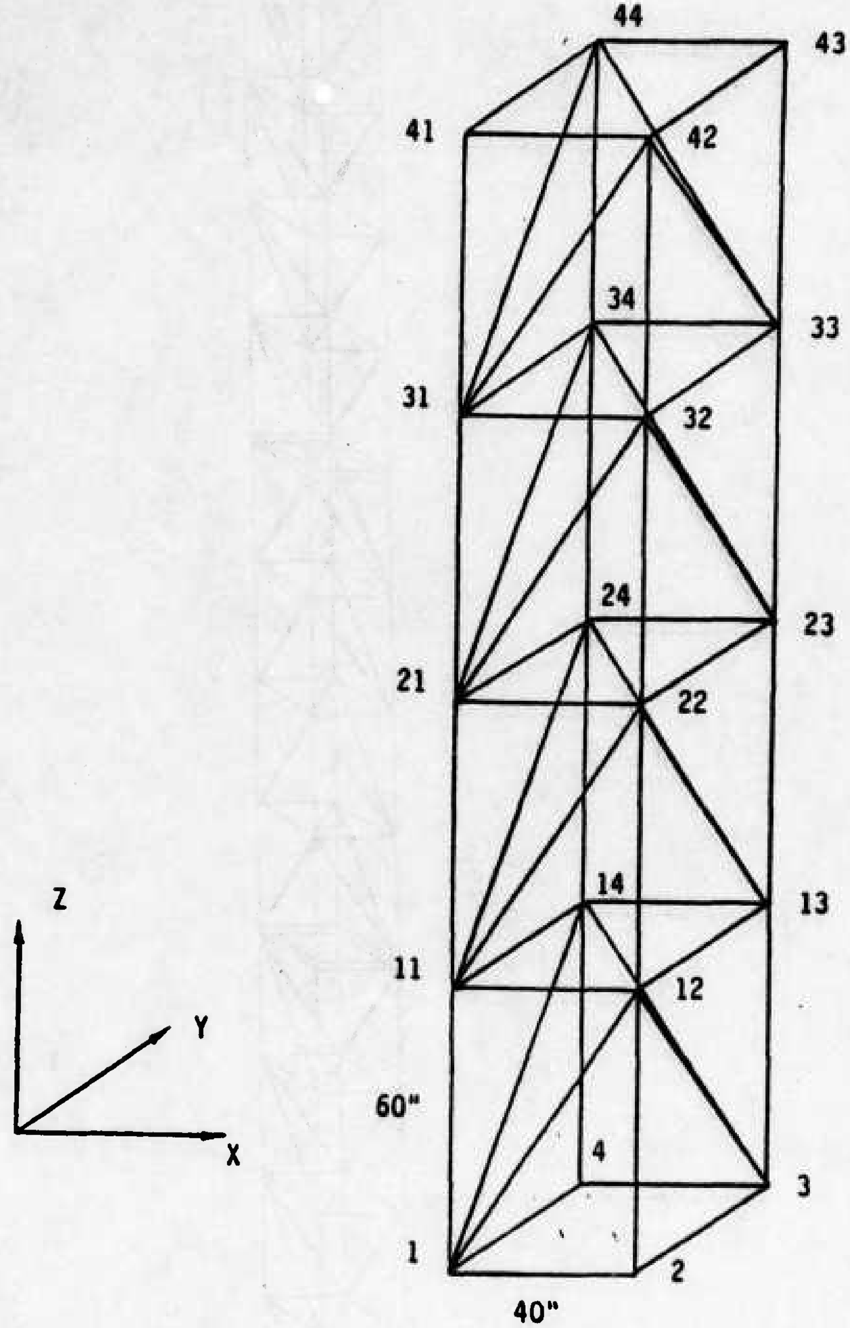

Figure 13. PACOSS Segment 1.

```
LIST
DATA SET
HORIZ1
DATA MEMBER
CSF1
HORIZ1  /CSF1      ON FILE U1

***************       HORIZ1   /CSF1       ***************

1.5 DIA PLEXIGLASS TUBE, 1/8 WALL, 40 LONG

********************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF      - NUMBER OF DOF          =          24
  2 CDFLI     - (DOF) DOF NAMES
                XX     11   XX     12   XX     21   XX     22   XX     31
                XX     32   YY     12   YY     13   YY     22   YY     23
                YY     32   YY     33   XX     13   XX     14   XX     23
                XX     24   XX     33   XX     34   YY     11   YY     14
                YY     21   YY     24   YY     31   YY     34
                                                                  MORE...
  3 CM          - (REAL) MASS MATRIX
                NULL MATRIX

  4 CC          - (REAL) DAMPING MATRIX
                NULL MATRIX

  5 CK          - (REAL) STIFFNESS MATRIX
                SYMMETRIC MATRIX (LOWER TRIANGLE PRINTED)

   ROW     1
          7.26700E+03
   ROW     2
         -7.26700E+03  7.26700E+03
   ROW     3
          0.00000E+00  0.00000E+00  7.26700E+03
   ROW     4
          0.00000E+00  0.00000E+00 -7.26700E+03  7.26700E+03
   ROW     5
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          7.26700E+03
   ROW     6
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                                  MORE...
```

```
    -7.26700E+03  7.26700E+03
ROW    7
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  7.26700E+03
ROW    8
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00 -7.26700E+03  7.26700E+03
ROW    9
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     7.26700E+03
ROW   10
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    -7.26700E+03  7.26700E+03
ROW   11
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  7.26700E+03
ROW   12
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                       MORE...
     0.00000E+00  0.00000E+00 -7.26700E+03  7.26700E+03
ROW   13
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     7.26700E+03
ROW   14
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    -7.26700E+03  7.26700E+03
ROW   15
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  7.26700E+03
ROW   16
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00 -7.26700E+03  7.26700E+03
ROW   17
                                                       MORE...
```

```
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          7.26700E+03
ROW       18
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         -7.26700E+03  7.26700E+03
ROW       19
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  7.26700E+03
ROW       20
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                            MORE...
          0.00000E+00  0.00000E+00 -7.26700E+03  7.26700E+03
ROW       21
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          7.26700E+03
ROW       22
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         -7.26700E+03  7.26700E+03
ROW       23
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  7.26700E+03
                                                            MORE...
```

```
   ROW    24
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00 -7.26700E+03  7.26700E+03
  6 CF       - (REAL) FORCE VECTOR
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
*********************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
HORIZ2
DATA MEMBER
CSF1
HORIZ2  /CSF1      ON FILE U1


* *************       HORIZ2  /CSF1       ***************

1.5 X 1.5 ALUMINUM TUBE, 1/8 WALL, 40 LONG

**********************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF      - NUMBER OF DOF        =            16
  2 CDFLI     - (DOF) DOF NAMES
            XX      1  XX      2  XX     41  XX     42  YY      2
            YY      3  YY     42  YY     43  XX      3  XX      4
            XX     43  XX     44  YY      1  YY      4  YY     41
            YY     44
  3 CM        - (REAL) MASS MATRIX
                                                                MORE...
            NULL MATRIX

  4 CC        - (REAL) DAMPING MATRIX
            NULL MATRIX

  5 CK        - (REAL) STIFFNESS MATRIX
            SYMMETRIC MATRIX (LOWER TRIANGLE PRINTED)

     ROW     1
            1.77031E+05
     ROW     2
           -1.77031E+05  1.77031E+05
     ROW     3
            0.00000E+00  0.00000E+00  1.77031E+05
     ROW     4
            0.00000E+00  0.00000E+00 -1.77031E+05  1.77031E+05
     ROW     5
            0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
            1.77031E+05
     ROW     6
            0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           -1.77031E+05  1.77031E+05
                                                                MORE...
```

```
ROW    7
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  1.77031E+05
ROW    8
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00 -1.77031E+05  1.77031E+05
ROW    9
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      1.77031E+05
ROW   10
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     -1.77031E+05  1.77031E+05
ROW   11
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  1.77031E+05
ROW   12
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00 -1.77031E+05  1.77031E+05
                                                          MORE...
ROW   13
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      1.77031E+05
ROW   14
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     -1.77031E+05  1.77031E+05
ROW   15
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  1.77031E+05
ROW   16
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00 -1.77031E+05  1.77031E+05
6 CF         - (REAL) FORCE VECTOR
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                          MORE...
```

```
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
************************************************************************

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
DIAG
DATA MEMBER
CSF1
DIAG    /CSF1      ON FILE U1

***************       DIAG    /CSF1       ***************

1.5 DIA PLEXIGLASS TUBE, 1/8 WALL, 72 LONG

*******************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF      - NUMBER OF DOF         =          32
  2 CDFLI     - (DOF) DOF NAMES
              XZ      1  XZ     12  XZ     11  XZ     22  XZ     21
              XZ     32  XZ     31  XZ     42  YZ      3  YZ     12
              YZ     13  YZ     22  YZ     23  YZ     32  YZ     33
              YZ     42  XZ      3  XZ     14  XZ     13  XZ     24
              XZ     23  XZ     34  XZ     33  XZ     44  YZ      1
                                                                MORE...
              YZ     14  YZ     11  YZ     24  YZ     21  YZ     34
              YZ     31  YZ     44
  3 CM        - (REAL) MASS MATRIX
              NULL MATRIX

  4 CC        - (REAL) DAMPING MATRIX
              NULL MATRIX

  5 CK        - (REAL) STIFFNESS MATRIX
              SYMMETRIC MATRIX (LOWER TRIANGLE PRINTED)

    ROW     1
            4.03100E+03
    ROW     2
           -4.03100E+03  4.03100E+03
    ROW     3
            0.00000E+00  0.00000E+00  4.03100E+03
    ROW     4
            0.00000E+00  0.00000E+00 -4.03100E+03  4.03100E+03
    ROW     5
            0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
            4.03100E+03
                                                                MORE...
```

```
ROW    6
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
      -4.03100E+03   4.03100E+03
ROW    7
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   4.03100E+03
ROW    8
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00  -4.03100E+03   4.03100E+03
ROW    9
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       4.03100E+03
ROW   10
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
      -4.03100E+03   4.03100E+03
ROW   11
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   4.03100E+03
ROW   12
                                                            MORE...
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00  -4.03100E+03   4.03100E+03
ROW   13
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       4.03100E+03
ROW   14
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
      -4.03100E+03   4.03100E+03
ROW   15
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   4.03100E+03
ROW   16
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
       0.00000E+00   0.00000E+00   0.00000E+00   0.00000E+00
                                                            MORE...
```

```
      0.00000E+00  0.00000E+00 -4.03100E+03  4.03100E+03
ROW   17
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      4.03100E+03
ROW   18
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     -4.03100E+03  4.03100E+03
ROW   19
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  4.03100E+03
ROW   20
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                        MORE...
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00 -4.03100E+03  4.03100E+03
ROW   21
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      4.03100E+03
ROW   22
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     -4.03100E+03  4.03100E+03
ROW   23
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                        MORE...
```

```
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  4.03100E+03
ROW      24
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00 -4.03100E+03  4.03100E+03
ROW      25
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         4.03100E+03
ROW      26
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                          MORE...
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        -4.03100E+03  4.03100E+03
ROW      27
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  4.03100E+03
ROW      28
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00 -4.03100E+03  4.03100E+03
ROW      29
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                          MORE...
```

```
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        4.03100E+03
   ROW  30
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       -4.03100E+03  4.03100E+03
   ROW  31
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                    MORE...
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  4.03100E+03
   ROW  32
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00 -4.03100E+03  4.03100E+03
  6 CF       - (REAL) FORCE VECTOR
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
*************************************************************************

                                                    MORE...

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
DIAG1
DATA MEMBER
CLC1
DIAG1   /CLC1      ON FILE U1

***************       DIAG1   /CLC1       ***************

COUPLE DIAGONAL AND HORIZONTAL MEMBERS - XZ

**********************************************************************
INPUT FOR COMPONENT CLC1. LINEAR CONSTRAINTS

  1 NCDF      - NUMBER OF DOF        =           16
  2 CDFLI     - (DOF) DOF NAMES
            XX     1  XX    12  XX    11  XX    22  XX    21
            XX    32  XX    31  XX    42  XX     3  XX    14
            XX    13  XX    24  XX    23  XX    34  XX    33
            XX    44
  3 NCIDF     - # OF CONSTRAINT EQNS=              16
                                                        MORE...
  4 CIDFLI    - (DOF) IMPLICIT DOF NAMES
            XZ     1  XZ    12  XZ    11  XZ    22  XZ    21
            XZ    32  XZ    31  XZ    42  XZ     3  XZ    14
            XZ    13  XZ    24  XZ    23  XZ    34  XZ    33
            XZ    44
  5 COEF      - (REAL) COEFFICIENT MATRIX
            DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

      5.54700E-01  5.54700E-01  5.54700E-01  5.54700E-01  5.54700E-01
      5.54700E-01  5.54700E-01  5.54700E-01 -5.54700E-01 -5.54700E-01
     -5.54700E-01 -5.54700E-01 -5.54700E-01 -5.54700E-01 -5.54700E-01
     -5.54700E-01
**********************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
DIAG2
DATA MEMBER
CLC1
DIAG2    /CLC1       ON FILE U1

***************          DIAG2    /CLC1         ***************

COUPLE DIAGONAL AND HORIZONTAL MEMBERS - YZ

**********************************************************************
INPUT FOR COMPONENT CLC1. LINEAR CONSTRAINTS

  1 NCDF       - NUMBER OF DOF         =           16
  2 CDFLI      - (DOF) DOF NAMES
           YY      3  YY     12  YY     13  YY     22  YY     23
           YY     32  YY     33  YY     42  YY      1  YY     14
           YY     11  YY     24  YY     21  YY     34  YY     31
           YY     44
  3 NCIDF      - # OF CONSTRAINT EQNS=             16
                                                              MORE...
  4 CIDFLI     - (DOF) IMPLICIT DOF NAMES
           YZ      3  YZ     12  YZ     13  YZ     22  YZ     23
           YZ     32  YZ     33  YZ     42  YZ      1  YZ     14
           YZ     11  YZ     24  YZ     21  YZ     34  YZ     31
           YZ     44
  5 COEF       - (REAL) COEFFICIENT MATRIX
           DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

     -5.54700E-01 -5.54700E-01 -5.54700E-01 -5.54700E-01 -5.54700E-01
     -5.54700E-01 -5.54700E-01 -5.54700E-01  5.54700E-01  5.54700E-01
      5.54700E-01  5.54700E-01  5.54700E-01  5.54700E-01  5.54700E-01
      5.54700E-01
**********************************************************************


LIST COMPLETE
COMMAND
```

```
RUN
MODEL NAME (DATA SET)
HORIZ
LIST MODEL SUMMARY (Y OR N)
Y

************************        MODEL HORIZ      ***********************

COUPLED DIAGONAL AND HORIZONTAL MEMBERS

INDEX    COMP    NO.    DATA SET        FORCE    DATA SET

  1      CSF1           HORIZ1          NONE
  2      CSF1           HORIZ2          NONE
  3      CSF1           DIAG            NONE
  4      CLC1           DIAG1           NONE
  5      CLC1           DIAG2           NONE

**********************************************************************

**********************************************************************
                                                              MORE...
                        GLOBAL  VARIABLES

 NO INPUT REQUIRED
**********************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
*********************************************************************
DETAILS (Y OR N)
Y


 *********************************************************************
                  COMPONENT DOF/SYSTEM DOF
              1, 6          2, 7          3, 8          4, 9          5, 10


 1   CSF1     XX     11     XX     12     XX     21     XX     22     XX     31
              XX     32     YY     12     YY     13     YY     22     YY     23
              YY     32     YY     33     XX     13     XX     14     XX     23
                                                                      MORE...
```

```
             XX   24   XX   33   XX   34   YY   11   YY   14
             YY   21   YY   24   YY   31   YY   34
             (    1)   (    2)   (    3)   (    4)   (    5)
             (    6)   (    7)   (    8)   (    9)   (   10)
             (   11)   (   12)   (   13)   (   14)   (   15)
             (   16)   (   17)   (   18)   (   19)   (   20)
             (   21)   (   22)   (   23)   (   24)

 2  CSF1     XX    1   XX    2   XX   41   XX   42   YY    2
             YY    3   YY   42   YY   43   XX    3   XX    4
             XX   43   XX   44   YY    1   YY    4   YY   41
             YY   44
             (   25)   (   26)   (   27)   (   28)   (   29)
             (   30)   (   31)   (   32)   (   33)   (   34)
             (   35)   (   36)   (   37)   (   38)   (   39)
             (   40)

 3  CSF1     XZ    1   XZ   12   XZ   11   XZ   22   XZ   21
             XZ   32   XZ   31   XZ   42   YZ    3   YZ   12
             YZ   13   YZ   22   YZ   23   YZ   32   YZ   33
             YZ   42   XZ    3   XZ   14   XZ   13   XZ   24
             XZ   23   XZ   34   XZ   33   XZ   44   YZ    1
                                                     MORE...
             YZ   14   YZ   11   YZ   24   YZ   21   YZ   34
             YZ   31   YZ   44
             (   -1)   (   -2)   (   -3)   (   -4)   (   -5)
             (   -6)   (   -7)   (   -8)   (   -9)   (  -10)
             (  -11)   (  -12)   (  -13)   (  -14)   (  -15)
             (  -16)   (  -17)   (  -18)   (  -19)   (  -20)
             (  -21)   (  -22)   (  -23)   (  -24)   (  -25)
             (  -26)   (  -27)   (  -28)   (  -29)   (  -30)
             (  -31)   (  -32)

 4  CLC1     XX    1   XX   12   XX   11   XX   22   XX   21
             XX   32   XX   31   XX   42   XX    3   XX   14
             XX   13   XX   24   XX   23   XX   34   XX   33
             XX   44
             (   25)   (    2)   (    1)   (    4)   (    3)
             (    6)   (    5)   (   28)   (   33)   (   14)
             (   13)   (   16)   (   15)   (   18)   (   17)
             (   36)

 5  CLC1     YY    3   YY   12   YY   13   YY   22   YY   23
             YY   32   YY   33   YY   42   YY    1   YY   14
             YY   11   YY   24   YY   21   YY   34   YY   31
                                                     MORE...
```

```
YY     44
 (  30)      (   7)      (   8)      (   9)      (  10)
 (  11)      (  12)      (  31)      (  37)      (  20)
 (  19)      (  22)      (  21)      (  24)      (  23)
 (  40)

SYSTEM DOF

 1    XX    11
 2    XX    12
 3    XX    21
 4    XX    22
 5    XX    31
 6    XX    32
 7    YY    12
 8    YY    13
 9    YY    22
10    YY    23
11    YY    32
12    YY    33
13    XX    13
                                                MORE...
14    XX    14
15    XX    23
16    XX    24
17    XX    33
18    XX    34
19    YY    11
20    YY    14
21    YY    21
22    YY    24
23    YY    31
24    YY    34
25    XX     1
26    XX     2
27    XX    41
28    XX    42
29    YY     2
30    YY     3
31    YY    42
32    YY    43
33    XX     3
34    XX     4
35    XX    43
                                                MORE...
```

```
        36      XX      44
        37      YY       1
        38      YY       4
        39      YY      41
        40      YY      44


                   IMPLICIT COEFFICIENTS

      I      COEF            DOF           I      COEF            DOF

      1    5.547E-01      *XX      1      17   -5.547E-01      *XX      3
      2    5.547E-01      *XX     12      18   -5.547E-01      *XX     14
      3    5.547E-01      *XX     11      19   -5.547E-01      *XX     13
      4    5.547E-01      *XX     22      20   -5.547E-01      *XX     24
      5    5.547E-01      *XX     21      21   -5.547E-01      *XX     23
      6    5.547E-01      *XX     32      22   -5.547E-01      *XX     34
      7    5.547E-01      *XX     31      23   -5.547E-01      *XX     33
      8    5.547E-01      *XX     42      24   -5.547E-01      *XX     44
      9   -5.547E-01      *YY      3      25    5.547E-01      *YY      1
     10   -5.547E-01      *YY     12      26    5.547E-01      *YY     14
     11   -5.547E-01      *YY     13      27    5.547E-01      *YY     11
                                                                   MORE...
     12   -5.547E-01      *YY     22      28    5.547E-01      *YY     24
     13   -5.547E-01      *YY     23      29    5.547E-01      *YY     21
     14   -5.547E-01      *YY     32      30    5.547E-01      *YY     34
     15   -5.547E-01      *YY     33      31    5.547E-01      *YY     31
     16   -5.547E-01      *YY     42      32    5.547E-01      *YY     44
PRINT MATRICES (Y OR N)
N
****************************************************************
SOLUTION OR N
N
COMMAND
```

```
LIST
DATA SET
HORIZ
DATA MEMBER
CSF1
HORIZ    /CSF1      ON FILE U1

***************       HORIZ   /CSF1       ***************

COUPLED DIAGONAL AND HORIZONTAL MEMBERS

*********************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF      - NUMBER OF DOF        =              40
  2 CDFLI     - (DOF) DOF NAMES
           XX     11  XX     12  XX     21  XX     22  XX     31
           XX     32  YY     12  YY     13  YY     22  YY     23
           YY     32  YY     33  XX     13  XX     14  XX     23
           XX     24  XX     33  XX     34  YY     11  YY     14
           YY     21  YY     24  YY     31  YY     34  XX      1
                                                              MORE...
           XX      2  XX     41  XX     42  YY      2  YY      3
           YY     42  YY     43  XX      3  XX      4  XX     43
           XX     44  YY      1  YY      4  YY     41  YY     44
  3 CM        - (REAL) MASS MATRIX
           NULL MATRIX

  4 CC        - (REAL) DAMPING MATRIX
           NULL MATRIX

  5 CK        - (REAL) STIFFNESS MATRIX
           SYMMETRIC MATRIX (LOWER TRIANGLE PRINTED)

    ROW    1
          8.50730E+03
    ROW    2
         -7.26700E+03  8.50730E+03
    ROW    3
          0.00000E+00  0.00000E+00  8.50730E+03
    ROW    4
         -1.24031E+03  0.00000E+00 -7.26700E+03  8.50730E+03
    ROW    5
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                              MORE...
```

```
     8.50730E+03
ROW    6
     0.00000E+00  0.00000E+00 -1.24031E+03  0.00000E+00
    -7.26700E+03  8.50730E+03
ROW    7
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  8.50730E+03
ROW    8
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00 -7.26700E+03  8.50730E+03
ROW    9
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00 -1.24031E+03
     8.50730E+03
ROW   10
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    -7.26700E+03  8.50730E+03
ROW   11
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00 -1.24031E+03  8.50730E+03
                                                      MORE...
ROW   12
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00 -7.26700E+03  8.50730E+03
ROW   13
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     8.50730E+03
ROW   14
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    -7.26700E+03  8.50730E+03
ROW   15
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  8.50730E+03
ROW   16
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                      MORE...
```

```
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         -1.24031E+03  0.00000E+00 -7.26700E+03  8.50730E+03
ROW       17
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          8.50730E+03
ROW       18
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00 -1.24031E+03  0.00000E+00
         -7.26700E+03  8.50730E+03
ROW       19
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  8.50730E+03
ROW       20
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                              MORE...
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00 -7.26700E+03  8.50730E+03
ROW       21
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          8.50730E+03
ROW       22
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00 -1.24031E+03  0.00000E+00
         -7.26700E+03  8.50730E+03
ROW       23
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                              MORE...
```

```
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  8.50730E+03
ROW  24
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    -1.24031E+03  0.00000E+00 -7.26700E+03  8.50730E+03
ROW  25
     0.00000E+00 -1.24031E+03  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     1.78271E+05
ROW  26
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                        MORE...
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    -1.77031E+05  1.77031E+05
ROW  27
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  1.77031E+05
ROW  28
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    -1.24031E+03  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00 -1.77031E+05  1.78271E+05
ROW  29
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                        MORE...
```

```
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     1.77031E+05
ROW  30
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00 -1.24031E+03  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    -1.77031E+05  1.78271E+05
ROW  31
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00 -1.24031E+03
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                       MORE...
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  1.78271E+05
ROW  32
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00 -1.77031E+05  1.77031E+05
ROW  33
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00 -1.24031E+03  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     1.78271E+05
                                                       MORE...
```

```
ROW    34
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      -1.77031E+05  1.77031E+05
ROW    35
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  1.77031E+05
ROW    36
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                         MORE...
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
      -1.24031E+03  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00 -1.77031E+05  1.78271E+05
ROW    37
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00 -1.24031E+03
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       1.78271E+05
ROW    38
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                         MORE...
```

```
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
       -1.77031E+05  1.77031E+05
   ROW  39
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  1.77031E+05
   ROW  40
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                         MORE...
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00 -1.24031E+03  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
        0.00000E+00  0.00000E+00 -1.77031E+05  1.78271E+05
  6 CF        - (REAL) FORCE VECTOR
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
*******************************************************************

                                                         MORE...

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
VERT
DATA MEMBER
CFM2
VERT     /CFM2      ON FILE U1

***************       VERT     /CFM2       ***************

1.5 X 1.5 ALUMINUM TUBE, 1/8 WALL, 240 LONG

*********************************************************************
INPUT FOR STRUCTURAL     COMPONENT CFM2. MODAL FUSELAGE

  1 RBM       - RIGID BODY MODES     =          YES
  2 IXCG      - LONGITUDINAL         =          NO
  3 IYCG      - LATERAL              =          YES
  4 IZCG      - VERTICAL             =          YES
  5 IROLL     - ROLL                 =          NO
  6 IPTCH     - PITCH                =          YES
  7 IYAW      - YAW                  =          YES
                                                              MORE...
  8 CG        - CG STATION (IN)      =  1.20000E+02
  9 NMODE     - NO. OF ELASTIC MODES=             6
 10 NS        - NO. FUSELAGE STAS    =             5
 11 X         - (REAL) INPUT STATION VALUES
              0.00000E+00  6.00000E+01  1.20000E+02  1.80000E+02
              2.40000E+02
 12 VC1       - MODE1 VERTICAL COMP =           YES
 13 Z1        - (REAL) MODE1 VERTICAL DISP
              2.00000E+00 -1.98400E-01 -1.21560E+00 -1.98400E-01
              2.00000E+00
 14 ZP1       - (REAL) MODE1 VERTICAL SLOPE
             -3.87270E-02  0.00000E+00  0.00000E+00  0.00000E+00
              3.87270E-02
 15 LC1       - MODE1 LATERAL COMP  =           NO
 16 TC1       - MODE1 TORSION COMP  =           NO
 17 VC2       - MODE2 VERTICAL COMP =           YES
 18 Z2        - (REAL) MODE2 VERTICAL DISP
              2.00000E+00 -1.16940E+00  0.00000E+00  1.16940E+00
             -2.00000E+00
 19 ZP2       - (REAL) MODE2 VERTICAL SLOPE
             -6.54940E-02  0.00000E+00  0.00000E+00  0.00000E+00
             -6.54940E-02
                                                              MORE...
```

```
20 LC2        - MODE2 LATERAL COMP  =        NO
21 TC2        - MODE2 TORSION COMP  =        NO
22 VC3        - MODE3 VERTICAL COMP =        YES
23 Z3         - (REAL) MODE3 VERTICAL DISP
               2.00000E+00 -1.24220E+00  1.42240E+00 -1.24220E+00
               2.00000E+00
24 ZP3        - (REAL) MODE3 VERTICAL SLOPE
              -9.16270E-02  0.00000E+00  0.00000E+00  0.00000E+00
               9.16270E-02
25 LC3        - MODE3 LATERAL COMP  =        NO
26 TC3        - MODE3 TORSION COMP  =        NO
27 VC4        - MODE4 VERTICAL COMP =        NO
28 LC4        - MODE4 LATERAL COMP  =        YES
29 Y4         - (REAL) MODE4 LATERAL DISP
               2.00000E+00 -1.98400E-01 -1.21560E+00 -1.98400E-01
               2.00000E+00
30 YP4        - (REAL) MODE4 LATERAL SLOPE
              -3.87270E-02  0.00000E+00  0.00000E+00  0.00000E+00
               3.87270E-02
31 TC4        - MODE4 TORSION COMP  =        NO
32 VC5        - MODE5 VERTICAL COMP =        NO
33 LC5        - MODE5 LATERAL COMP  =        YES
                                                               MORE...
34 Y5         - (REAL) MODE5 LATERAL DISP
               2.00000E+00 -1.16940E+00  0.00000E+00  1.16940E+00
              -2.00000E+00
35 YP5        - (REAL) MODE5 LATERAL SLOPE
              -6.54940E-02  0.00000E+00  0.00000E+00  0.00000E+00
              -6.54940E-02
36 TC5        - MODE5 TORSION COMP  =        NO
37 VC6        - MODE6 VERTICAL COMP =        NO
38 LC6        - MODE6 LATERAL COMP  =        YES
39 Y6         - (REAL) MODE6 LATERAL DISP
               2.00000E+00 -1.24220E+00  1.42240E+00 -1.24220E+00
               2.00000E+00
40 YP6        - (REAL) MODE6 LATERAL SLOPE
              -9.16270E-02  0.00000E+00  0.00000E+00  0.00000E+00
               9.16270E-02
41 TC6        - MODE6 TORSION COMP  =        NO
42 NR         - NO. OF ROTORS       =           0
43 NI         - NO. OTHER IMPLCT DOF=           0
44 MASSL      - FUSELAGE MASS  (LB) =  1.58430E+01
45 IMYF       - PITCH MOI ABOUT CG  =  1.64010E+01
46 IMZF       - YAW   MOI ABOUT CG  =  1.64010E+01
47 MMS        - (REAL) MODAL MASS (SLUGS)
                                                               MORE...
```

```
             4.92030E-01  4.92030E-01  4.92030E-01  4.92030E-01
             4.92030E-01  4.92030E-01
 48 MD       - (REAL) MODAL DAMPING (PCT)
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00
 49 FREQ     - (REAL) MODAL FREQUENCY (HZ)
             7.09000E+00  1.95500E+01  3.83300E+01  7.09000E+00
             1.95500E+01  3.83300E+01
*****************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
VERT
DATA MEMBER
CFM2
VERT    /CFM2     ON FILE U1


***************       VERT    /CFM2       ***************

1.5 X 1.5 ALUMINUM TUBE, 3/16 WALL, 240 LONG

*******************************************************************
INPUT FOR STRUCTURAL     COMPONENT CFM2. MODAL FUSELAGE

  1 RBM        - RIGID BODY MODES     =          YES
  2 IXCG       - LONGITUDINAL         =          NO
  3 IYCG       - LATERAL              =          YES
  4 IZCG       - VERTICAL             =          YES
  5 IROLL      - ROLL                 =          NO
  6 IPTCH      - PITCH                =          YES
  7 IYAW       - YAW                  =          YES
                                                               MORE...
  8 CG         - CG STATION (IN)      =  1.20000E+02
  9 NMODE      - NO. OF ELASTIC MODES=              6
 10 NS         - NO. FUSELAGE STAS    =             5
 11 X          - (REAL) INPUT STATION VALUES
               0.00000E+00  6.00000E+01  1.20000E+02  1.80000E+02
               2.40000E+02
 12 VC1        - MODE1 VERTICAL COMP =          YES
 13 Z1         - (REAL) MODE1 VERTICAL DISP
               2.00000E+00 -1.98400E-01 -1.21560E+00 -1.98400E-01
               2.00000E+00
 14 ZP1        - (REAL) MODE1 VERTICAL SLOPE
              -3.87270E-02  0.00000E+00  0.00000E+00  0.00000E+00
               3.87270E-02
 15 LC1        - MODE1 LATERAL COMP  =          NO
 16 TC1        - MODE1 TORSION COMP  =          NO
 17 VC2        - MODE2 VERTICAL COMP =          YES
 18 Z2         - (REAL) MODE2 VERTICAL DISP
               2.00000E+00 -1.16940E+00  0.00000E+00  1.16940E+00
              -2.00000E+00
 19 ZP2        - (REAL) MODE2 VERTICAL SLOPE
              -6.54940E-02  0.00000E+00  0.00000E+00  0.00000E+00
              -6.54940E-02
                                                               MORE...
```

```
20 LC2        - MODE2 LATERAL COMP  =         NO
21 TC2        - MODE2 TORSION COMP  =         NO
22 VC3        - MODE3 VERTICAL COMP =         YES
23 Z3         - (REAL) MODE3 VERTICAL DISP
               2.00000E+00 -1.24220E+00  1.42240E+00 -1.24220E+00
               2.00000E+00
24 ZP3        - (REAL) MODE3 VERTICAL SLOPE
              -9.16270E-02  0.00000E+00  0.00000E+00  0.00000E+00
               9.16270E-02
25 LC3        - MODE3 LATERAL COMP  =         NO
26 TC3        - MODE3 TORSION COMP  =         NO
27 VC4        - MODE4 VERTICAL COMP =         NO
28 LC4        - MODE4 LATERAL COMP  =         YES
29 Y4         - (REAL) MODE4 LATERAL DISP
               2.00000E+00 -1.98400E-01 -1.21560E+00 -1.98400E-01
               2.00000E+00
30 YP4        - (REAL) MODE4 LATERAL SLOPE
              -3.87270E-02  0.00000E+00  0.00000E+00  0.00000E+00
               3.87270E-02
31 TC4        - MODE4 TORSION COMP  =         NO
32 VC5        - MODE5 VERTICAL COMP =         NO
33 LC5        - MODE5 LATERAL COMP  =         YES
                                                            MORE...
34 Y5         - (REAL) MODE5 LATERAL DISP
               2.00000E+00 -1.16940E+00  0.00000E+00  1.16940E+00
              -2.00000E+00
35 YP5        - (REAL) MODE5 LATERAL SLOPE
              -6.54940E-02  0.00000E+00  0.00000E+00  0.00000E+00
              -6.54940E-02
36 TC5        - MODE5 TORSION COMP  =         NO
37 VC6        - MODE6 VERTICAL COMP =         NO
38 LC6        - MODE6 LATERAL COMP  =         YES
39 Y6         - (REAL) MODE6 LATERAL DISP
               2.00000E+00 -1.24220E+00  1.42240E+00 -1.24220E+00
               2.00000E+00
40 YP6        - (REAL) MODE6 LATERAL SLOPE
              -9.16270E-02  0.00000E+00  0.00000E+00  0.00000E+00
               9.16270E-02
41 TC6        - MODE6 TORSION COMP  =         NO
42 NR         - NO. OF ROTORS       =            0
43 NI         - NO. OTHER IMPLCT DOF=            0
44 MASSL      - FUSELAGE MASS  (LB) =  2.26850E+01
45 IMYF       - PITCH MOI ABOUT CG  =  2.34840E+01
46 IMZF       - YAW   MOI ABOUT CG  =  2.34840E+01
47 MMS        - (REAL) MODAL MASS (SLUGS)
                                                            MORE...
```

```
                 7.04510E-01  7.04510E-01  7.04510E-01  7.04510E-01
                 7.04510E-01  7.04510E-01
 48 MD           - (REAL) MODAL DAMPING (PCT)
                 0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                 0.00000E+00  0.00000E+00
 49 FREQ         - (REAL) MODAL FREQUENCY (HZ)
                 6.81000E+00  1.87800E+01  3.68100E+01  6.81000E+00
                 1.87800E+01  3.68100E+01
*****************************************************************

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
VERT1
DATA MEMBER
CLC2
VERT1   /CLC2      ON FILE U1

***************       VERT1   /CLC2      ***************

COUPLE VERTICAL AND HORIZONTAL MEMBERS

*******************************************************************
INPUT FOR COMPONENT CLC2. LINEAR CONSTRAINTS

   1 NCDF      - NUMBER OF DOF       =            20
   2 CDFLI     - (DOF) DOF NAMES
           XX      1  XX      11  XX      21  XX      31  XX      41
           YY      1  YY      11  YY      21  YY      31  YY      41
           YCG 1000   ZCG 1000   PTCH1000   YAW 1000   QFUS1100
           QFUS1200   QFUS1300   QFUS1400   QFUS1500   QFUS1600
   3 NCIDF     - NO OF CONSTRAINT EQS=            10
                                                                  MORE...
   4 COEF      - (REAL) COEFFICIENT MATRIX
           GENERAL MATRIX

     ROW    1
        -1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  1.00000E+00
        -1.20000E+02  0.00000E+00  2.00000E+00 -2.00000E+00
         2.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     ROW    2
         0.00000E+00 -1.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  1.00000E+00
        -6.00000E+01  0.00000E+00 -1.98400E-01  1.16940E+00
        -1.24220E+00  0.00000E+00  0.00000E+00  0.00000E+00
     ROW    3
         0.00000E+00  0.00000E+00 -1.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         0.00000E+00  0.00000E+00  0.00000E+00  1.00000E+00
         0.00000E+00  0.00000E+00 -1.21560E+00  0.00000E+00
         1.42240E+00  0.00000E+00  0.00000E+00  0.00000E+00
     ROW    4
                                                                  MORE...
```

```
     0.00000E+00  0.00000E+00  0.00000E+00 -1.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  1.00000E+00
     6.00000E+01  0.00000E+00 -1.98400E-01 -1.16940E+00
    -1.24220E+00  0.00000E+00  0.00000E+00  0.00000E+00
ROW   5
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    -1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  1.00000E+00
     1.20000E+02  0.00000E+00  2.00000E+00  2.00000E+00
     2.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
ROW   6
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00 -1.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  1.00000E+00  0.00000E+00
     0.00000E+00  1.20000E+02  0.00000E+00  0.00000E+00
     0.00000E+00  2.00000E+00 -2.00000E+00  2.00000E+00
ROW   7
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00 -1.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  1.00000E+00  0.00000E+00
     0.00000E+00  6.00000E+01  0.00000E+00  0.00000E+00
                                                      MORE...
     0.00000E+00 -1.98400E-01  1.16940E+00 -1.24220E+00
ROW   8
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00 -1.00000E+00
     0.00000E+00  0.00000E+00  1.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00 -1.21560E+00  0.00000E+00  1.42240E+00
ROW   9
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    -1.00000E+00  0.00000E+00  1.00000E+00  0.00000E+00
     0.00000E+00 -6.00000E+01  0.00000E+00  0.00000E+00
     0.00000E+00 -1.98400E-01 -1.16940E+00 -1.24220E+00
ROW  10
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     0.00000E+00 -1.00000E+00  1.00000E+00  0.00000E+00
     0.00000E+00 -1.20000E+02  0.00000E+00  0.00000E+00
     0.00000E+00  2.00000E+00  2.00000E+00  2.00000E+00
5 NIDOF     - NO OF IMPLICIT DOF  =           10
6 INDEX     - IMPLICIT DOF INDICES
                 11         12         13         14         15
                                                      MORE...
```

16 17 18 19 20

```
**************************************************************************
```

LIST COMPLETE
COMMAND

```
LIST
DATA SET
VERT2
DATA MEMBER
CLC2
VERT2   /CLC2     ON FILE U1

***************        VERT2   /CLC2       ***************

COUPLE VERTICAL AND HORIZONTAL MEMBERS

*******************************************************************
INPUT FOR COMPONENT CLC2. LINEAR CONSTRAINTS

  1 NCDF      - NUMBER OF DOF       =           20
  2 CDFLI     - (DOF) DOF NAMES
           XX      2  XX     12  XX     22  XX     32  XX     42
           YY      2  YY     12  YY     22  YY     32  YY     42
           YCG 2000   ZCG 2000   PTCH2000   YAW 2000   QFUS2100
           QFUS2200   QFUS2300   QFUS2400   QFUS2500   QFUS2600
  3 NCIDF     - NO OF CONSTRAINT EQS=           10
```

```
LIST
DATA SET
VERT3
DATA MEMBER
CLC2
VERT3   /CLC2      ON FILE U1

***************       VERT3   /CLC2       ***************

COUPLE VERTICAL AND HORIZONTAL MEMBERS

*******************************************************************
INPUT FOR COMPONENT CLC2. LINEAR CONSTRAINTS

  1 NCDF      - NUMBER OF DOF         =         20
  2 CDFLI     - (DOF) DOF NAMES
            XX       3  XX      13  XX      23  XX      33  XX      43
            YY       3  YY      13  YY      23  YY      33  YY      43
            YCG 3000  ZCG 3000  PTCH3000  YAW 3000  QFUS3100
            QFUS3200  QFUS3300  QFUS3400  QFUS3500  QFUS3600
  3 NCIDF     - NO OF CONSTRAINT EQS=         10
```

```
LIST
DATA SET
VERT4
DATA MEMBER
CLC2
VERT4    /CLC2      ON FILE U1

***************         VERT4    /CLC2       ***************

COUPLE VERTICAL AND HORIZONTAL MEMBERS

*******************************************************************
INPUT FOR COMPONENT CLC2. LINEAR CONSTRAINTS

  1 NCDF      - NUMBER OF DOF         =           20
  2 CDFLI     - (DOF) DOF NAMES
           XX      4  XX     14  XX     24  XX     34  XX     44
           YY      4  YY     14  YY     24  YY     34  YY     44
           YCG  4000  ZCG  4000  PTCH4000  YAW  4000  QFUS4100
           QFUS4200  QFUS4300  QFUS4400  QFUS4500  QFUS4600
  3 NCIDF     - NO OF CONSTRAINT EQS=             10
```

```
LIST
DATA SET
MASS
DATA MEMBER
CSF1
MASS    /CSF1      ON FILE U1

***************        MASS    /CSF1        ***************

LUMPED MASSES

*************************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF     - NUMBER OF DOF          =         40
  2 CDFLI    - (DOF) DOF NAMES
           XX     1  XX    11  XX    21  XX    31  XX    41
           YY     1  YY    11  YY    21  YY    31  YY    41
           XX     2  XX    12  XX    22  XX    32  XX    42
           YY     2  YY    12  YY    22  YY    32  YY    42
           XX     3  XX    13  XX    23  XX    33  XX    43
                                                           MORE...
           YY     3  YY    13  YY    23  YY    33  YY    43
           XX     4  XX    14  XX    24  XX    34  XX    44
           YY     4  YY    14  YY    24  YY    34  YY    44
  3 CM       - (REAL) MASS MATRIX
           DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

      1.00470E-02  7.15730E-03  7.15730E-03  7.15730E-03  7.93120E-03
      1.00470E-02  7.15730E-03  7.15730E-03  7.15730E-03  7.93120E-03
      7.93120E-03  7.15730E-03  7.15730E-03  7.15730E-03  1.00470E-02
      7.93120E-03  7.15730E-03  7.15730E-03  7.15730E-03  1.00470E-02
      1.00470E-02  7.15730E-03  7.15730E-03  7.15730E-03  7.93120E-03
      1.00470E-02  7.15730E-03  7.15730E-03  7.15730E-03  7.93120E-03
      7.93120E-03  7.15730E-03  7.15730E-03  7.15730E-03  1.00470E-02
      7.93120E-03  7.15730E-03  7.15730E-03  7.15730E-03  1.00470E-02
  4 CC       - (REAL) DAMPING MATRIX
           NULL MATRIX

  5 CK       - (REAL) STIFFNESS MATRIX
           NULL MATRIX

  6 CF       - (REAL) FORCE VECTOR
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                           MORE...
```

```
0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
*****************************************************************************

LIST COMPLETE
COMMAND
```

```
RUN
MODEL NAME (DATA SET)
S1
LIST MODEL SUMMARY (Y OR N)
Y

*************************      MODEL S1        ********************

PACOSS STRUCTURE SEGMENT 1

INDEX    COMP     NO.    DATA SET        FORCE    DATA SET

  1      CSF1            HORIZ           NONE
  2      CFM2      1     VERT            NONE
  3      CFM2      2     VERT            NONE
  4      CFM2      3     VERT            NONE
  5      CFM2      4     VERT            NONE
  6      CLC2            VERT1           NONE
  7      CLC2            VERT2           NONE
  8      CLC2            VERT3           NONE
  9      CLC2            VERT4           NONE
                                                           MORE...
 10      CSF1            MASS            NONE
********************************************************************

********************************************************************
                            GLOBAL  VARIABLES

 NO INPUT REQUIRED
********************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
********************************************************************
DETAILS (Y OR N)
Y

 *******************************************************************
                         COMPONENT DOF/SYSTEM DOF
                  1, 6         2, 7         3, 8         4, 9       5, 10
                                                                   MORE...
```

```
1   CSF1     XX      11     XX      12     XX      21     XX      22     XX      31
             XX      32     YY      12     YY      13     YY      22     YY      23
             YY      32     YY      33     XX      13     XX      14     XX      23
             XX      24     XX      33     XX      34     YY      11     YY      14
             YY      21     YY      24     YY      31     YY      34     XX       1
             XX       2     XX      41     XX      42     YY       2     YY       3
             YY      42     YY      43     XX       3     XX       4     XX      43
             XX      44     YY       1     YY       4     YY      41     YY      44
               (   1)         (   2)         (   3)         (   4)         (   5)
               (   6)         (   7)         (   8)         (   9)         (  10)
               (  11)         (  12)         (  13)         (  14)         (  15)
               (  16)         (  17)         (  18)         (  19)         (  20)
               (  21)         (  22)         (  23)         (  24)         (  25)
               (  26)         (  27)         (  28)         (  29)         (  30)
               (  31)         (  32)         (  33)         (  34)         (  35)
               (  36)         (  37)         (  38)         (  39)         (  40)

2   CFM2     YCG  1000      ZCG  1000      PTCH1000       YAW  1000      QFUS1100
             QFUS1200       QFUS1300       QFUS1400       QFUS1500       QFUS1600
               (  -1)         (  -6)         ( -11)         ( -16)         ( -21)
                                                                       MORE...
               ( -26)         ( -31)         ( -36)         ( -41)         ( -46)

3   CFM2     YCG  2000      ZCG  2000      PTCH2000       YAW  2000      QFUS2100
             QFUS2200       QFUS2300       QFUS2400       QFUS2500       QFUS2600
               ( -51)         ( -56)         ( -61)         ( -66)         ( -71)
               ( -76)         ( -81)         ( -86)         ( -91)         ( -96)

4   CFM2     YCG  3000      ZCG  3000      PTCH3000       YAW  3000      QFUS3100
             QFUS3200       QFUS3300       QFUS3400       QFUS3500       QFUS3600
               (-101)         (-106)         (-111)         (-116)         (-121)
               (-126)         (-131)         (-136)         (-141)         (-146)

5   CFM2     YCG  4000      ZCG  4000      PTCH4000       YAW  4000      QFUS4100
             QFUS4200       QFUS4300       QFUS4400       QFUS4500       QFUS4600
               (-151)         (-156)         (-161)         (-166)         (-171)
               (-176)         (-181)         (-186)         (-191)         (-196)

6   CLC2     XX       1     XX      11     XX      21     XX      31     XX      41
             YY       1     YY      11     YY      21     YY      31     YY      41
               (  25)         (   1)         (   3)         (   5)         (  27)
               (  37)         (  19)         (  21)         (  23)         (  39)

                                                                       MORE...
```

```
 7  CLC2   XX     2   XX    12   XX    22   XX    32   XX    42
            YY     2   YY    12   YY    22   YY    32   YY    42
            (   26)    (    2)    (    4)    (    6)    (   28)
            (   29)    (    7)    (    9)    (   11)    (   31)

 8  CLC2   XX     3   XX    13   XX    23   XX    33   XX    43
            YY     3   YY    13   YY    23   YY    33   YY    43
            (   33)    (   13)    (   15)    (   17)    (   35)
            (   30)    (    8)    (   10)    (   12)    (   32)

 9  CLC2   XX     4   XX    14   XX    24   XX    34   XX    44
            YY     4   YY    14   YY    24   YY    34   YY    44
            (   34)    (   14)    (   16)    (   18)    (   36)
            (   38)    (   20)    (   22)    (   24)    (   40)

10  CSF1   XX     1   XX    11   XX    21   XX    31   XX    41
            YY     1   YY    11   YY    21   YY    31   YY    41
            XX     2   XX    12   XX    22   XX    32   XX    42
            YY     2   YY    12   YY    22   YY    32   YY    42
            XX     3   XX    13   XX    23   XX    33   XX    43
            YY     3   YY    13   YY    23   YY    33   YY    43
            XX     4   XX    14   XX    24   XX    34   XX    44
                                                      MORE...
            YY     4   YY    14   YY    24   YY    34   YY    44
            (   25)    (    1)    (    3)    (    5)    (   27)
            (   37)    (   19)    (   21)    (   23)    (   39)
            (   26)    (    2)    (    4)    (    6)    (   28)
            (   29)    (    7)    (    9)    (   11)    (   31)
            (   33)    (   13)    (   15)    (   17)    (   35)
            (   30)    (    8)    (   10)    (   12)    (   32)
            (   34)    (   14)    (   16)    (   18)    (   36)
            (   38)    (   20)    (   22)    (   24)    (   40)


        SYSTEM DOF

        1    XX    11
        2    XX    12
        3    XX    21
        4    XX    22
        5    XX    31
        6    XX    32
        7    YY    12
        8    YY    13
        9    YY    22

                                                      MORE...
```

10	YY	23
11	YY	32
12	YY	33
13	XX	13
14	XX	14
15	XX	23
16	XX	24
17	XX	33
18	XX	34
19	YY	11
20	YY	14
21	YY	21
22	YY	24
23	YY	31
24	YY	34
25	XX	1
26	XX	2
27	XX	41
28	XX	42
29	YY	2
30	YY	3
31	YY	42

MORE...

32	YY	43
33	XX	3
34	XX	4
35	XX	43
36	XX	44
37	YY	1
38	YY	4
39	YY	41
40	YY	44

IMPLICIT COEFFICIENTS

I	COEF	DOF		I	COEF	DOF	
1	9.787E-02	YY	1	101	9.787E-02	YY	3
2	2.881E-01	YY	11	102	2.881E-01	YY	13
3	2.280E-01	YY	21	103	2.280E-01	YY	23
4	2.881E-01	YY	31	104	2.881E-01	YY	33
5	9.787E-02	*YY	41	105	9.787E-02	*YY	43
6	9.787E-02	XX	1	106	9.787E-02	XX	3
7	2.881E-01	XX	11	107	2.881E-01	XX	13

MORE...

8	2.280E-01	XX	21	108	2.280E-01	XX	23
9	2.881E-01	XX	31	109	2.881E-01	XX	33
10	9.787E-02	*XX	41	110	9.787E-02	*XX	43
11	-2.246E-03	XX	1	111	-2.246E-03	XX	3
12	-3.841E-03	XX	11	112	-3.841E-03	XX	13
13	1.863E-09	XX	21	113	1.863E-09	XX	23
14	3.841E-03	XX	31	114	3.841E-03	XX	33
15	2.246E-03	*XX	41	115	2.246E-03	*XX	43
16	2.246E-03	YY	1	116	2.246E-03	YY	3
17	3.841E-03	YY	11	117	3.841E-03	YY	13
18	1.863E-09	YY	21	118	1.863E-09	YY	23
19	-3.841E-03	YY	31	119	-3.841E-03	YY	33
20	-2.246E-03	*YY	41	120	-2.246E-03	*YY	43
21	1.455E-01	XX	1	121	1.455E-01	XX	3
22	3.154E-02	XX	11	122	3.154E-02	XX	13
23	-3.541E-01	XX	21	123	-3.541E-01	XX	23
24	3.154E-02	XX	31	124	3.154E-02	XX	33
25	1.455E-01	*XX	41	125	1.455E-01	*XX	43
26	-1.152E-01	XX	1	126	-1.152E-01	XX	3
27	2.305E-01	XX	11	127	2.305E-01	XX	13
28	-5.960E-08	XX	21	128	-5.960E-08	XX	23
29	-2.305E-01	XX	31	129	-2.305E-01	XX	33

MORE....

30	1.152E-01	*XX	41	130	1.152E-01	*XX	43
31	5.555E-02	XX	1	131	5.555E-02	XX	3
32	-1.756E-01	XX	11	132	-1.756E-01	XX	13
33	2.401E-01	XX	21	133	2.401E-01	XX	23
34	-1.756E-01	XX	31	134	-1.756E-01	XX	33
35	5.555E-02	*XX	41	135	5.555E-02	*XX	43
36	1.455E-01	YY	1	136	1.455E-01	YY	3
37	3.154E-02	YY	11	137	3.154E-02	YY	13
38	-3.541E-01	YY	21	138	-3.541E-01	YY	23
39	3.154E-02	YY	31	139	3.154E-02	YY	33
40	1.455E-01	*YY	41	140	1.455E-01	*YY	43
41	-1.152E-01	YY	1	141	-1.152E-01	YY	3
42	2.305E-01	YY	11	142	2.305E-01	YY	13
43	5.960E-08	YY	21	143	5.960E-08	YY	23
44	-2.305E-01	YY	31	144	-2.305E-01	YY	33
45	1.152E-01	*YY	41	145	1.152E-01	*YY	43
46	5.555E-02	YY	1	146	5.555E-02	YY	3
47	-1.756E-01	YY	11	147	-1.756E-01	YY	13
48	2.401E-01	YY	21	148	2.401E-01	YY	23
49	-1.756E-01	YY	31	149	-1.756E-01	YY	33
50	5.555E-02	*YY	41	150	5.555E-02	*YY	43
51	9.787E-02	YY	2	151	9.787E-02	YY	4

MORE...

52	2.881E-01	YY	12	152	2.881E-01	YY	14
53	2.280E-01	YY	22	153	2.280E-01	YY	24
54	2.881E-01	YY	32	154	2.881E-01	YY	34
55	9.787E-02	*YY	42	155	9.787E-02	*YY	44
56	9.787E-02	XX	2	156	9.787E-02	XX	4
57	2.881E-01	XX	12	157	2.881E-01	XX	14
58	2.280E-01	XX	22	158	2.280E-01	XX	24
59	2.881E-01	XX	32	159	2.881E-01	XX	34
60	9.787E-02	*XX	42	160	9.787E-02	*XX	44
61	-2.246E-03	XX	2	161	-2.246E-03	XX	4
62	-3.841E-03	XX	12	162	-3.841E-03	XX	14
63	1.863E-09	XX	22	163	1.863E-09	XX	24
64	3.841E-03	XX	32	164	3.841E-03	XX	34
65	2.246E-03	*XX	42	165	2.246E-03	*XX	44
66	2.246E-03	YY	2	166	2.246E-03	YY	4
67	3.841E-03	YY	12	167	3.841E-03	YY	14
68	1.863E-09	YY	22	168	1.863E-09	YY	24
69	-3.841E-03	YY	32	169	-3.841E-03	YY	34
70	-2.246E-03	*YY	42	170	-2.246E-03	*YY	44
71	1.455E-01	XX	2	171	1.455E-01	XX	4
72	3.154E-02	XX	12	172	3.154E-02	XX	14
73	-3.541E-01	XX	22	173	-3.541E-01	XX	24

MORE...

74	3.154E-02	XX	32	174	3.154E-02	XX	34
75	1.455E-01	*XX	42	175	1.455E-01	*XX	44
76	-1.152E-01	XX	2	176	-1.152E-01	XX	4
77	2.305E-01	XX	12	177	2.305E-01	XX	14
78	-5.960E-08	XX	22	178	-5.960E-08	XX	24
79	-2.305E-01	XX	32	179	-2.305E-01	XX	34
80	1.152E-01	*XX	42	180	1.152E-01	*XX	44
81	5.555E-02	XX	2	181	5.555E-02	XX	4
82	-1.756E-01	XX	12	182	-1.756E-01	XX	14
83	2.401E-01	XX	22	183	2.401E-01	XX	24
84	-1.756E-01	XX	32	184	-1.756E-01	XX	34
85	5.555E-02	*XX	42	185	5.555E-02	*XX	44
86	1.455E-01	YY	2	186	1.455E-01	YY	4
87	3.154E-02	YY	12	187	3.154E-02	YY	14
88	-3.541E-01	YY	22	188	-3.541E-01	YY	24
89	3.154E-02	YY	32	189	3.154E-02	YY	34
90	1.455E-01	*YY	42	190	1.455E-01	*YY	44
91	-1.152E-01	YY	2	191	-1.152E-01	YY	4
92	2.305E-01	YY	12	192	2.305E-01	YY	14
93	5.960E-08	YY	22	193	5.960E-08	YY	24
94	-2.305E-01	YY	32	194	-2.305E-01	YY	34
95	1.152E-01	*YY	42	195	1.152E-01	*YY	44

MORE...

```
    96    5.555E-02     YY     2    196    5.555E-02     YY     4
    97   -1.756E-01     YY    12    197   -1.756E-01     YY    14
    98    2.401E-01     YY    22    198    2.401E-01     YY    24
    99   -1.756E-01     YY    32    199   -1.756E-01     YY    34
   100    5.555E-02    *YY    42    200    5.555E-02    *YY    44
PRINT MATRICES (Y OR N)
N
***************************************************************************
SOLUTION OR N
SEA4
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION SEA4. EIGEN ANALYSIS

BEGIN INPUT
-----
NMODES   (INTEGER)
    NUMBER OF MODES
ENTER     1 INTEGER VALUE(S)
8
                                                                  MORE...
***************************************************************************
SOLUTION INPUT FOR SEA4.EIGEN ANALYSIS

  1 NMODES   - NUMBER OF MODES     =             8
***************************************************************************

RE-ENTER (Y OR N)
N

***************** SOLUTION SEA4 FOR MODEL S1       *****************
MODEL     - PACOSS STRUCTURE SEGMENT 1
SOLUTION - EIGEN ANALYSIS


WARNING: NEGATIVE EIGENVALUE (SET TO 0)
WARNING: NEGATIVE EIGENVALUE (SET TO 0)
WARNING: NEGATIVE EIGENVALUE (SET TO 0)
WARNING: NEGATIVE EIGENVALUE (SET TO 0)


MODE          1           2           3           4           5
                                                                  MORE...
```

FREQ	HZ	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.8886E+01
	RAD/S	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.1867E+02
GEN	MASS	2.2800E-01	3.5845E-01	2.8496E-01	1.9553E-01	1.7829E-01
SYS	DOF					
XX	11	0.0409	0.1759	0.5396	0.9975	-0.0799
XX	12	0.0410	0.1759	0.5396	0.9974	-0.0897
XX	21	0.0404	0.1759	0.5401	0.9981	0.0062
XX	22	0.0405	0.1759	0.5400	0.9980	-0.0066
XX	31	0.0400	0.1761	0.5409	0.9990	0.0894
XX	32	0.0401	0.1761	0.5407	0.9989	0.0796
YY	12	-0.4199	-0.7386	0.9979	-0.2848	0.6981
YY	13	-0.4199	-0.7386	0.9979	-0.2848	0.6225
YY	22	-0.4202	-0.7390	0.9981	-0.2850	0.0512
YY	23	-0.4203	-0.7391	0.9982	-0.2850	-0.0482
YY	32	-0.4209	-0.7397	0.9988	-0.2852	-0.6202
YY	33	-0.4210	-0.7399	0.9989	-0.2852	-0.6961
XX	13	0.4888	0.9993	0.6911	-0.3698	0.2272
XX	14	0.4888	0.9993	0.6910	-0.3698	0.2548
XX	23	0.4888	0.9992	0.6915	-0.3699	-0.0181
						MORE...
XX	24	0.4888	0.9992	0.6914	-0.3699	0.0182
XX	33	0.4891	0.9993	0.6922	-0.3701	-0.2549
XX	34	0.4891	0.9993	0.6921	-0.3701	-0.2272
YY	11	0.9997	-0.8067	0.0595	0.0207	0.6057
YY	14	0.9997	-0.8067	0.0595	0.0207	0.6796
YY	21	0.9997	-0.8071	0.0599	0.0206	-0.0486
YY	24	0.9997	-0.8071	0.0599	0.0206	0.0483
YY	31	0.9994	-0.8072	0.0600	0.0206	-0.6796
YY	34	0.9994	-0.8072	0.0600	0.0206	-0.6058
XX	1	0.0412	0.1760	0.5394	0.9972	-0.1283
XX	2	0.0412	0.1760	0.5394	0.9972	-0.1284
XX	41	0.0399	0.1763	0.5416	1.0000	0.1283
XX	42	0.0399	0.1764	0.5416	1.0000	0.1282
YY	2	-0.4198	-0.7386	0.9981	-0.2848	1.0000
YY	3	-0.4198	-0.7386	0.9981	-0.2848	0.9990
YY	42	-0.4219	-0.7406	1.0000	-0.2855	-0.9984
YY	43	-0.4219	-0.7406	1.0000	-0.2855	-0.9994
XX	3	0.4890	0.9996	0.6911	-0.3699	0.3649
XX	4	0.4890	0.9996	0.6911	-0.3699	0.3652
XX	43	0.4898	1.0000	0.6930	-0.3705	-0.3656
XX	44	0.4898	1.0000	0.6930	-0.3705	-0.3652
YY	1	1.0000	-0.8067	0.0591	0.0208	0.9734
						MORE...

YY	4	1.0000	-0.8067	0.0591	0.0208	0.9744
YY	41	0.9997	-0.8077	0.0601	0.0206	-0.9744
YY	44	0.9997	-0.8077	0.0601	0.0206	-0.9734

MODE		6	7	8
FREQ	HZ	1.8893E+01	1.8896E+01	1.8897E+01
	RAD/S	1.1871E+02	1.1873E+02	1.1874E+02
GEN MASS		1.5624E-01	9.6617E-02	8.9382E-02
SYS DOF				
XX	11	-0.1390	0.0818	0.6224
XX	12	-0.1559	0.0917	0.6981
XX	21	0.0108	-0.0063	-0.0487
XX	22	-0.0114	0.0067	0.0507
XX	31	0.1555	-0.0914	-0.6965
XX	32	0.1385	-0.0814	-0.6207
YY	12	0.5794	-0.2422	0.1486
YY	13	0.5165	-0.2159	0.1325

MORE...

YY	22	0.0418	-0.0171	0.0110
YY	23	-0.0407	0.0174	-0.0102
YY	32	-0.5158	0.2160	-0.1318
YY	33	-0.5788	0.2423	-0.1480
XX	13	0.1968	0.6219	-0.0359
XX	14	0.2207	0.6976	-0.0402
XX	23	-0.0156	-0.0492	0.0028
XX	24	0.0159	0.0501	-0.0029
XX	33	-0.2207	-0.6968	0.0400
XX	34	-0.1967	-0.6211	0.0357
YY	11	-0.6218	-0.0007	-0.0406
YY	14	-0.6975	-0.0007	-0.0455
YY	21	0.0494	0.0002	0.0029
YY	24	-0.0499	0.0000	-0.0035
YY	31	0.6973	0.0011	0.0449
YY	34	0.6215	0.0009	0.0400
XX	1	-0.2231	0.1312	0.9990
XX	2	-0.2233	0.1314	1.0000
XX	41	0.2232	-0.1312	-0.9993
XX	42	0.2229	-0.1311	-0.9983
YY	2	0.8303	-0.3473	0.2128
YY	3	0.8295	-0.3470	0.2126

MORE...

```
YY    42    -0.8294     0.3469     -0.2121
YY    43    -0.8302     0.3472     -0.2124
XX     3     0.3160     0.9990     -0.0577
XX     4     0.3163     1.0000     -0.0577
XX    43    -0.3165    -0.9994      0.0573
XX    44    -0.3162    -0.9985      0.0572
YY     1    -0.9987    -0.0012     -0.0650
YY     4    -0.9997    -0.0012     -0.0651
YY    41     1.0000     0.0015      0.0646
YY    44     0.9990     0.0015      0.0645
THE PERFORMANCE INDEX IS     0.007622
*** THE EIGEN-ANALYSIS HAS BEEN PERFORMED WELL (SATISFACTORILY, POORLY)
IF P IS LESS THAN 1 (BETWEEN 1 AND 100, GREATER THAN 100).
*********************************************************************
COMMAND
```

```
LIST
DATA SET
S1
DATA MEMBER
CFM3
S1       /CFM3      ON FILE U3


***************        S1        /CFM3        ***************

SEGMENT 1

**********************************************************************
INPUT FOR STRUCTURAL      COMPONENT CFM3. 3-D MODAL FUSELAGE

  1 RBM        - RIGID BODY MODES     =          YES
  2 IXCG       - LONGITUDINAL         =          NO
  3 IYCG       - LATERAL              =          YES
  4 IZCG       - VERTICAL             =          YES
  5 IROLL      - ROLL                 =          NO
  6 IPTCH      - PITCH                =          YES
  7 IYAW       - YAW                  =          YES
                                                            MORE...
  8 CG         - (REAL) XYZ CG LOCATION (IN)
               0.00000E+00  0.00000E+00  0.00000E+00
  9 NS         - NO. OF NODAL POINTS =             4
 10 XYZNS      - (REAL) XYZ FOR EACH NODE
              GENERAL MATRIX

    ROW     1
          -1.20000E+02 -1.20000E+02 -1.20000E+02 -1.20000E+02
    ROW     2
          -2.00000E+01 -2.00000E+01  2.00000E+01  2.00000E+01
    ROW     3
          -2.00000E+01  2.00000E+01  2.00000E+01 -2.00000E+01
 11 NMODE      - NO. OF ELASTIC MODES=             4
 12 MXCG       - MODE X-COMPONENT     =          NO
 13 MYCG       - MODE Y-COMPONENT     =          YES
 14 MZCG       - MODE Z-COMPONENT     =          YES
 15 MROLL      - MODE ALFX-COMPONENT =           NO
 16 MPTCH      - MODE ALFY-COMPONENT =           NO
 17 MYAW       - MODE ALFZ-COMPONENT =           NO
 18 YY         - (REAL) MODES Y-COMPONENT
              GENERAL MATRIX

                                                            MORE...
```

```
    ROW    1
          -9.99700E-01 -3.92300E-01 -3.92700E-01 -9.98700E-01
    ROW    2
          -3.86500E-01  2.04600E-01  2.04800E-01 -3.86100E-01
    ROW    3
           2.22200E-01 -9.98100E-01 -9.99100E-01  2.22000E-01
    ROW    4
           3.31100E-01 -7.72200E-01 -7.73000E-01  3.30800E-01
 19 ZZ         - (REAL) MODES Z-COMPONENT
            GENERAL MATRIX

    ROW    1
           2.02000E-02  2.02000E-02  2.97200E-01  2.96900E-01
    ROW    2
          -4.46900E-01 -4.46400E-01 -9.99300E-01 -9.98300E-01
    ROW    3
           7.45900E-01  7.45200E-01 -6.24800E-01 -6.24200E-01
    ROW    4
          -9.99800E-01 -9.98800E-01  1.60800E-01  1.60700E-01
 20 NODOF      - DOF Y OR N FOR NODES
ROW      1
            NO  NO  NO  NO
                                                        MORE...
ROW      2
            YES YES YES YES
ROW      3
            YES YES YES YES
ROW      4
            NO  NO  NO  NO
ROW      5
            NO  NO  NO  NO
ROW      6
            NO  NO  NO  NO
 21 XYZD       - (REAL) LOCAL X,Y VECTORS
            GENERAL MATRIX

    ROW    1
           1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
    ROW    2      NULL ROW
    ROW    3      NULL ROW
    ROW    4      NULL ROW
    ROW    5
           1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
    ROW    6      NULL ROW
 22 MASSL     - FUSELAGE MASS  (LB) =  1.69280E+02
                                                        MORE...
```

```
 23 IMYY      - PTCH MOI SLUG-FT(SQ)=  1.79650E+02
 24 IMZZ      - YAW MOI SLUG-FT(SQ) =  1.79650E+02
 25 IMYZ      - YZ PRODUCT OF INERT.=  0.00000E+00
 26 MMS       - (REAL) MODAL MASS (SLUGS)
              1.05580E-01  1.18160E-01  1.69490E-01  1.47230E-01
 27 MD        - (REAL) MODAL DAMPING (PCT)
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 28 FREQ      - (REAL) MODAL FREQUENCY (HZ)
              1.88940E+01  1.88960E+01  1.88990E+01  1.89080E+01
**********************************************************************

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
S2
DATA MEMBER
CFM3
S2       /CFM3      ON FILE U3

***************       S2       /CFM3       ***************

SEGMENT 2

*********************************************************************
INPUT FOR STRUCTURAL     COMPONENT CFM3. 3-D MODAL FUSELAGE

  1 RBM      - RIGID BODY MODES     =          YES
  2 IXCG     - LONGITUDINAL         =          NO
  3 IYCG     - LATERAL              =          YES
  4 IZCG     - VERTICAL             =          YES
  5 IROLL    - ROLL                 =          NO
  6 IPTCH    - PITCH                =          YES
  7 IYAW     - YAW                  =          YES
                                                              MORE...
  8 CG       - (REAL) XYZ CG LOCATION (IN)
               0.00000E+00  0.00000E+00  0.00000E+00
  9 NS       - NO. OF NODAL POINTS =                8
 10 XYZNS    - (REAL) XYZ FOR EACH NODE
           GENERAL MATRIX

    ROW     1
            1.20000E+02  1.20000E+02  1.20000E+02  1.20000E+02
           -1.20000E+02 -1.20000E+02 -1.20000E+02 -1.20000E+02
    ROW     2
           -2.00000E+01 -2.00000E+01  2.00000E+01  2.00000E+01
           -2.00000E+01 -2.00000E+01  2.00000E+01  2.00000E+01
    ROW     3
           -2.00000E+01  2.00000E+01  2.00000E+01 -2.00000E+01
           -2.00000E+01  2.00000E+01  2.00000E+01 -2.00000E+01
 11 NMODE    - NO. OF ELASTIC MODES=                4
 12 MXCG     - MODE X-COMPONENT     =          NO
 13 MYCG     - MODE Y-COMPONENT     =          YES
 14 MZCG     - MODE Z-COMPONENT     =          YES
 15 MROLL    - MODE ALFX-COMPONENT  =          NO
 16 MPTCH    - MODE ALFY-COMPONENT  =          NO
 17 MYAW     - MODE ALFZ-COMPONENT  =          NO
                                                              MORE...
```

```
18 YY          - (REAL) MODES Y-COMPONENT
             GENERAL MATRIX

   ROW     1
          9.99000E-01  3.93100E-01  3.92700E-01  1.00000E+00
         -9.99700E-01 -3.92300E-01 -3.92700E-01 -9.98700E-01
   ROW     2
          3.86800E-01 -2.05000E-01 -2.04800E-01  3.87200E-01
         -3.86500E-01  2.04600E-01  2.04800E-01 -3.86100E-01
   ROW     3
         -2.21900E-01  1.00000E+00  9.99000E-01 -2.22200E-01
          2.22200E-01 -9.98100E-01 -9.99100E-01  2.22000E-01
   ROW     4
         -3.31100E-01  7.72900E-01  7.72100E-01 -3.31500E-01
          3.31100E-01 -7.72200E-01 -7.73000E-01  3.30800E-01
19 ZZ          - (REAL) MODES Z-COMPONENT
             GENERAL MATRIX

   ROW     1
         -2.02000E-02 -2.03000E-02 -2.97100E-01 -2.97400E-01
          2.02000E-02  2.02000E-02  2.97200E-01  2.96900E-01
   ROW     2
                                                           MORE...
          4.46700E-01  4.47200E-01  9.99000E-01  1.00000E+00
         -4.46900E-01 -4.46400E-01 -9.99300E-01 -9.98300E-01
   ROW     3
         -7.45300E-01 -7.46000E-01  6.23500E-01  6.24100E-01
          7.45900E-01  7.45200E-01 -6.24800E-01 -6.24200E-01
   ROW     4
          9.99000E-01  1.00000E+00 -1.60100E-01 -1.60300E-01
         -9.99800E-01 -9.98800E-01  1.60800E-01  1.60700E-01
20 NODOF       - DOF Y OR N FOR NODES
ROW       1
             NO  NO  NO  NO  NO  NO  NO  NO
ROW       2
             YES YES YES YES YES YES YES YES
ROW       3
             YES YES YES YES YES YES YES YES
ROW       4
             NO  NO  NO  NO  NO  NO  NO  NO
ROW       5
             NO  NO  NO  NO  NO  NO  NO  NO
ROW       6
             NO  NO  NO  NO  NO  NO  NO  NO
21 XYZD        - (REAL) LOCAL X,Y VECTORS
                                                           MORE...
```

```
          GENERAL MATRIX

    ROW    1
         1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
         1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
    ROW    2      NULL ROW
    ROW    3      NULL ROW
    ROW    4      NULL ROW
    ROW    5
         1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
         1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
    ROW    6      NULL ROW
 22 MASSL     - FUSELAGE MASS  (LB) =  1.69280E+02
 23 IMYY      - PTCH MOI SLUG-FT(SQ)=  1.79650E+02
 24 IMZZ      - YAW MOI SLUG-FT(SQ) =  1.79650E+02
 25 IMYZ      - YZ PRODUCT OF INERT.=  0.00000E+00
 26 MMS       - (REAL) MODAL MASS (SLUGS)
              1.05580E-01  1.18160E-01  1.69490E-01  1.47230E-01
 27 MD        - (REAL) MODAL DAMPING (PCT)
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 28 FREQ      - (REAL) MODAL FREQUENCY (HZ)
              1.88940E+01  1.88960E+01  1.88990E+01  1.89080E+01
                                                          MORE...
******************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
S3
DATA MEMBER
CFM3
S3        /CFM3      ON FILE U3

***************       S3      /CFM3       ***************

SEGMENT 3

************************************************************************
INPUT FOR STRUCTURAL      COMPONENT CFM3. 3-D MODAL FUSELAGE

  1 RBM       - RIGID BODY MODES     =          YES
  2 IXCG      - LONGITUDINAL         =          NO
  3 IYCG      - LATERAL              =          YES
  4 IZCG      - VERTICAL             =          YES
  5 IROLL     - ROLL                 =          NO
  6 IPTCH     - PITCH                =          YES
  7 IYAW      - YAW                  =          YES
                                                              MORE...
  8 CG        - (REAL) XYZ CG LOCATION (IN)
              0.00000E+00  0.00000E+00  0.00000E+00
  9 NS        - NO. OF NODAL POINTS =              4
 10 XYZNS     - (REAL) XYZ FOR EACH NODE
            GENERAL MATRIX

    ROW    1
          1.20000E+02  1.20000E+02  1.20000E+02  1.20000E+02
    ROW    2
         -2.00000E+01 -2.00000E+01  2.00000E+01  2.00000E+01
    ROW    3
         -2.00000E+01  2.00000E+01  2.00000E+01 -2.00000E+01
 11 NMODE     - NO. OF ELASTIC MODES=              4
 12 MXCG      - MODE X-COMPONENT     =          NO
 13 MYCG      - MODE Y-COMPONENT     =          YES
 14 MZCG      - MODE Z-COMPONENT     =          YES
 15 MROLL     - MODE ALFX-COMPONENT  =          NO
 16 MPTCH     - MODE ALFY-COMPONENT  =          NO
 17 MYAW      - MODE ALFZ-COMPONENT  =          NO
 18 YY        - (REAL) MODES Y-COMPONENT
            GENERAL MATRIX

                                                              MORE...
```

```
   ROW    1
         7.12000E-02 -1.00000E+00 -9.99000E-01  7.12000E-02
   ROW    2
        -9.98900E-01 -5.69000E-02 -5.68000E-02 -9.99900E-01
   ROW    3
        -3.79000E-02 -4.48200E-01 -4.47800E-01 -3.79000E-02
   ROW    4
         6.84000E-02 -1.16100E-01 -1.16000E-01  6.85000E-02
 19 ZZ          - (REAL) MODES Z-COMPONENT
          GENERAL MATRIX

   ROW    1
        -3.91500E-01 -3.91900E-01  9.08000E-02  9.09000E-02
   ROW    2
        -2.02000E-02 -2.02000E-02  7.30000E-02  7.31000E-02
   ROW    3
         9.99000E-01  1.00000E+00 -5.90500E-01 -5.91000E-01
   ROW    4
         5.40500E-01  5.41000E-01  9.99000E-01  1.00000E+00
 20 NODOF       - DOF Y OR N FOR NODES
ROW       1
          NO   NO   NO   NO
                                                            MORE...
ROW       2
          YES  YES  YES  YES
ROW       3
          YES  YES  YES  YES
ROW       4
          NO   NO   NO   NO
ROW       5
          NO   NO   NO   NO
ROW       6
          NO   NO   NO   NO
 21 XYZD        - (REAL) LOCAL X,Y VECTORS
          GENERAL MATRIX

   ROW    1
         1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
   ROW    2      NULL ROW
   ROW    3      NULL ROW
   ROW    4      NULL ROW
   ROW    5
         1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
   ROW    6      NULL ROW
 22 MASSL       - FUSELAGE MASS  (LB) =  1.76120E+02
                                                            MORE...
```

```
 23 IMYY       - PTCH MOI SLUG-FT(SQ)=  1.86730E+02
 24 IMZZ       - YAW MOI SLUG-FT(SQ) =  1.86730E+02
 25 IMYZ       - YZ PRODUCT OF INERT.=  0.00000E+00
 26 MMS        - (REAL) MODAL MASS (SLUGS)
               1.18960E-01  1.02890E-01  1.58210E-01  1.33630E-01
 27 MD         - (REAL) MODAL DAMPING (PCT)
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
 28 FREQ       - (REAL) MODAL FREQUENCY (HZ)
               1.73660E+01  1.73720E+01  1.73810E+01  1.73850E+01
*********************************************************************

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
GROUND
DATA MEMBER
CLC0
GROUND  /CLC0      ON FILE U3


***************        GROUND  /CLC0       ***************

ELIMINATE END DOF

*******************************************************************
INPUT FOR COMPONENT CLC0. ELIMINATE DOF

  1 NCIDF    - # OF ELIMINATED DOF =            2
  2 CIDFLI   - ELIMINATED DOF NAMES=     YC  1000     ZC  1000
  3 CDFLI    - 1 EXPLICIT DOF NAME =     PH  1000
*******************************************************************


                                                           MORE...
LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
CJ1
DATA MEMBER
CLC2
CJ1      /CLC2      ON FILE U3

***************      CJ1     /CLC2      ***************

COUPLE JOINT 1 DOF

**********************************************************************
INPUT FOR COMPONENT CLC2. LINEAR CONSTRAINTS

  1 NCDF      - NUMBER OF DOF         =           16
  2 CDFLI     - (DOF) DOF NAMES
            YC  1000  YW  1000  YC  2000  YW  2000  ZC  1000
            PH  1000  ZC  2000  PH  2000  QF  1100  QF  1200
            QF  1300  QF  1400  QF  2100  QF  2200  QF  2300
            QF  2400
  3 NCIDF     - NO OF CONSTRAINT EQS=             8
                                                          MORE...
  4 COEF      - (REAL) COEFFICIENT MATRIX
            GENERAL MATRIX

    ROW     1
           1.00000E+00 -1.20000E+02 -1.00000E+00 -1.20000E+02
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          -9.99700E-01 -3.86500E-01  2.22200E-01  3.31100E-01
          -9.99000E-01 -3.86800E-01  2.21900E-01  3.31100E-01
    ROW     2
           1.00000E+00 -1.20000E+02 -1.00000E+00 -1.20000E+02
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          -3.92300E-01  2.04600E-01 -9.98100E-01 -7.72200E-01
          -3.93100E-01  2.05000E-01 -1.00000E+00 -7.72900E-01
    ROW     3
           1.00000E+00 -1.20000E+02 -1.00000E+00 -1.20000E+02
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          -3.92700E-01  2.04800E-01 -9.99100E-01 -7.73000E-01
          -3.92700E-01  2.04800E-01 -9.99000E-01 -7.72100E-01
    ROW     4
           1.00000E+00 -1.20000E+02 -1.00000E+00 -1.20000E+02
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
          -9.98700E-01 -3.86100E-01  2.22000E-01  3.30800E-01
                                                          MORE...
```

```
   -1.00000E+00 -3.87200E-01  2.22200E-01  3.31500E-01
 ROW    5
    0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    1.00000E+00  1.20000E+02 -1.00000E+00  1.20000E+02
    2.02000E-02 -4.46900E-01  7.45900E-01 -9.99800E-01
    2.02000E-02 -4.46700E-01  7.45300E-01 -9.99000E-01
 ROW    6
    0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    1.00000E+00  1.20000E+02 -1.00000E+00  1.20000E+02
    2.02000E-02 -4.46400E-01  7.45200E-01 -9.98800E-01
    2.03000E-02 -4.47200E-01  7.46000E-01 -1.00000E+00
 ROW    7
    0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    1.00000E+00  1.20000E+02 -1.00000E+00  1.20000E+02
    2.97200E-01 -9.99300E-01 -6.24800E-01  1.60800E-01
    2.97100E-01 -9.99000E-01 -6.23500E-01  1.60100E-01
 ROW    8
    0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
    1.00000E+00  1.20000E+02 -1.00000E+00  1.20000E+02
    2.96900E-01 -9.98300E-01 -6.24200E-01  1.60700E-01
    2.97400E-01 -1.00000E+00 -6.24100E-01  1.60300E-01
5 NIDOF     - NO OF IMPLICIT DOF  =            8
                                                         MORE...
6 INDEX     - IMPLICIT DOF INDICES
                   9          10          11          12          13
                  14          15          16
******************************************************************

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
CJ2
DATA MEMBER
CLC2
CJ2      /CLC2      ON FILE U3

***************      CJ2      /CLC2      ***************

COUPLE JOINT 2 DOF

*************************************************************************
INPUT FOR COMPONENT CLC2. LINEAR CONSTRAINTS

  1 NCDF      - NUMBER OF DOF         =           16
  2 CDFLI     - (DOF) DOF NAMES
            YC  2000  YW  2000  YC  3000  YW  3000  ZC  2000
            PH  2000  ZC  3000  PH  3000  QF  2100  QF  2200
            QF  2300  QF  2400  QF  3100  QF  3200  QF  3300
            QF  3400
  3 NCIDF     - NO OF CONSTRAINT EQS=             8
                                                            MORE...
  4 COEF      - (REAL) COEFFICIENT MATRIX
            GENERAL MATRIX

    ROW     1
          1.00000E+00 -1.20000E+02 -1.00000E+00 -1.20000E+02
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         -9.99700E-01 -3.86500E-01  2.22200E-01  3.31100E-01
         -7.12000E-02  9.98900E-01  3.79000E-02 -6.84000E-02
    ROW     2
          1.00000E+00 -1.20000E+02 -1.00000E+00 -1.20000E+02
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         -3.92300E-01  2.04600E-01 -9.98100E-01 -7.72200E-01
          1.00000E+00  5.69000E-02  4.48200E-01  1.16100E-01
    ROW     3
          1.00000E+00 -1.20000E+02 -1.00000E+00 -1.20000E+02
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         -3.92700E-01  2.04800E-01 -9.99100E-01 -7.73000E-01
          9.99000E-01  5.68000E-02  4.47800E-01  1.16000E-01
    ROW     4
          1.00000E+00 -1.20000E+02 -1.00000E+00 -1.20000E+02
          0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         -9.98700E-01 -3.86100E-01  2.22000E-01  3.30800E-01
                                                            MORE...
```

```
    -7.12000E-02  9.99900E-01  3.79000E-02 -6.85000E-02
 ROW     5
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     1.00000E+00  1.20000E+02 -1.00000E+00  1.20000E+02
     2.02000E-02 -4.46900E-01  7.45900E-01 -9.99800E-01
     3.91500E-01  2.02000E-02 -9.99000E-01 -5.40500E-01
 ROW     6
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     1.00000E+00  1.20000E+02 -1.00000E+00  1.20000E+02
     2.02000E-02 -4.46400E-01  7.45200E-01 -9.98800E-01
     3.91900E-01  2.02000E-02 -1.00000E+00 -5.41000E-01
 ROW     7
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     1.00000E+00  1.20000E+02 -1.00000E+00  1.20000E+02
     2.97200E-01 -9.99300E-01 -6.24800E-01  1.60800E-01
    -9.08000E-02 -7.30000E-02  5.90500E-01 -9.99000E-01
 ROW     8
     0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
     1.00000E+00  1.20000E+02 -1.00000E+00  1.20000E+02
     2.96900E-01 -9.98300E-01 -6.24200E-01  1.60700E-01
    -9.09000E-02 -7.31000E-02  5.91000E-01 -1.00000E+00
5 NIDOF     - NO OF IMPLICIT DOF  =             8
                                                            MORE...
6 INDEX     - IMPLICIT DOF INDICES
                    9          10          11          12          13
                   14          15          16
*********************************************************************

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
SUSP
DATA MEMBER
CSF1
SUSP     /CSF1      FOUND ON FOLLOWING MULTIPLES FILES
 U2   U3
ENTER CORRECT FILE
U3
SUSP     /CSF1      ON FILE U3


***************       SUSP    /CSF1       ***************

SOFT SUSPENSION

******************************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF       - NUMBER OF DOF         =          12
  2 CDFLI      - (DOF) DOF NAMES
           YC  1000  ZC  1000  PH  1000  YW  1000  YC  2000
                                                            MORE...
           ZC  2000  PH  2000  YW  2000  YC  3000  ZC  3000
           PH  3000  YW  3000
  3 CM         - (REAL) MASS MATRIX
           NULL MATRIX

  4 CC         - (REAL) DAMPING MATRIX
           NULL MATRIX

  5 CK         - (REAL) STIFFNESS MATRIX
           DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

      5.00000E+00  5.00000E+00  5.00000E+00  5.00000E+00  5.00000E+00
      5.00000E+00  5.00000E+00  5.00000E+00  5.00000E+00  5.00000E+00
      5.00000E+00  5.00000E+00
  6 CF         - (REAL) FORCE VECTOR
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
******************************************************************************


                                                            MORE...
LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
PLATE
DATA MEMBER
CSF1
PLATE    /CSF1      ON FILE U3

***************        PLATE   /CSF1       ***************

PLATE MASS

**********************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF      - NUMBER OF DOF          =             2
  2 CDFLI     - DOF NAMES              =      YC  3000      ZC  3000
  3 CM        - (REAL) MASS MATRIX
            DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

     1.00000E-01  1.00000E-01
  4 CC        - (REAL) DAMPING MATRIX
                                                                  MORE...
            NULL MATRIX

  5 CK        - (REAL) STIFFNESS MATRIX
            NULL MATRIX

  6 CF        - FORCE VECTOR           =  0.00000E+00  0.00000E+00
**********************************************************************


LIST COMPLETE
COMMAND
```

```
RUN
MODEL NAME (DATA SET)
PACOSSG
LIST MODEL SUMMARY (Y OR N)
Y

************************     MODEL PACOSSG    **********************

PACOSS TOWER (CANTILEVERED)

INDEX    COMP     NO.    DATA SET        FORCE    DATA SET
  1      CFM3      1     S1              NONE
  2      CFM3      2     S2              NONE
  3      CFM3      3     S3              NONE
  4      CLC0            GROUND          NONE
  5      CLC2            CJ1             NONE
  6      CLC2            CJ2             NONE
  7      CSF1            SUSP            NONE
  8      CSF1            PLATE           NONE

                                                              MORE...
Y

******************************************************************
                    COMPONENT DOF/SYSTEM DOF
              1, 6          2, 7          3, 8          4, 9          5, 10

  1  CFM3    YC  1000     ZC  1000     PH  1000     YW  1000     QF  1100
             QF  1200     QF  1300     QF  1400
             (    0)      (    0)      (    1)      (    2)      (   -1)
             (   -1)      (   -1)      (   -1)

  2  CFM3    YC  2000     ZC  2000     PH  2000     YW  2000     QF  2100
             QF  2200     QF  2300     QF  2400
             (    3)      (    4)      (    5)      (    6)      (   -1)
             (   -1)      (   -1)      (   -1)

  3  CFM3    YC  3000     ZC  3000     PH  3000     YW  3000     QF  3100
             QF  3200     QF  3300     QF  3400
             (    7)      (    8)      (    9)      (   10)      (   -1)
             (   -9)      ( -17)       ( -25)
                                                              MORE...
```

```
4  CLC0     PH  1000    YW  1000    YC  2000    YW  2000    ZC  1000
            PH  1000    ZC  2000    PH  2000
            (    1)     (    2)     (    3)     (    6)     (    0)
            (    1)     (    4)     (    5)

5  CLC2     YC  1000    YW  1000    YC  2000    YW  2000    ZC  1000
            PH  1000    ZC  2000    PH  2000
            (    0)     (    2)     (    3)     (    6)     (    0)
            (    1)     (    4)     (    5)

6  CLC2     YC  2000    YW  2000    YC  3000    YW  3000    ZC  2000
            PH  2000    ZC  3000    PH  3000
            (    3)     (    6)     (    7)     (   10)     (    4)
            (    5)     (    8)     (    9)

7  CSF1     YC  1000    ZC  1000    PH  1000    YW  1000    YC  2000
            ZC  2000    PH  2000    YW  2000    YC  3000    ZC  3000
            PH  3000    YW  3000
            (    0)     (    0)     (    1)     (    2)     (    3)
            (    4)     (    5)     (    6)     (    7)     (    8)
            (    9)     (   10)
                                                            MORE...

8  CSF1     YC  3000    ZC  3000
            (    7)     (    8)
```

SYSTEM DOF

```
   1    PH  1000
   2    YW  1000
   3    YC  2000
   4    ZC  2000
   5    PH  2000
   6    YW  2000
   7    YC  3000
   8    ZC  3000
   9    PH  3000
  10    YW  3000
```

IMPLICIT COEFFICIENTS

```
 I       COEF            DOF         I       COEF            DOF
                                                              MORE...
```

```
      1    -3.996E-01      YC   2000       17     -1.519E-01     YC   2000
      2     4.796E+01      YW   2000       18      1.823E+01     YW   2000
      3     3.996E-01      YC   3000       19      1.519E-01     YC   3000
      4     4.796E+01      YW   3000       20      1.823E+01     YW   3000
      5    -1.342E-01      ZC   2000       21      1.479E-01     ZC   2000
      6    -1.611E+01      PH   2000       22      1.774E+01     PH   2000
      7     1.342E-01      ZC   3000       23     -1.479E-01     ZC   3000
      8    -1.611E+01     *PH   3000       24      1.774E+01    *PH   3000
      9    -5.164E-01      YC   2000       25      3.052E-04     YC   2000
     10     6.193E+01      YW   2000       26     -3.516E-02     YW   2000
     11     5.164E-01      YC   3000       27     -3.052E-04     YC   3000
     12     6.193E+01      YW   3000       28     -3.516E-02     YW   3000
     13     3.603E-02      ZC   2000       29      5.981E-01     ZC   2000
     14     4.328E+00      PH   2000       30      7.177E+01     PH   2000
     15    -3.603E-02      ZC   3000       31     -5.981E-01     ZC   3000
     16     4.328E+00     *PH   3000       32      7.177E+01    *PH   3000
PRINT MATRICES (Y OR N)
                                                                  VM READ
N
**********************************************************************
SOLUTION OR N
SEA4
SAVE CASE FOR LATER EXECUTION (Y OR N)
N


SOLUTION SEA4. EIGEN ANALYSIS

BEGIN INPUT
-----
NMODES    (INTEGER)
   NUMBER OF MODES
ENTER     1 INTEGER VALUE(S)
10
***********************************************************************
SOLUTION INPUT FOR SEA4.EIGEN ANALYSIS

  1 NMODES    - NUMBER OF MODES       =            10
***********************************************************************

                                                                  MORE...
```

RE-ENTER (Y OR N)
N

```
***************** SOLUTION SEA4 FOR MODEL PACOSSG *****************
MODEL    - PACOSS TOWER (CANTILEVERED)
SOLUTION - EIGEN ANALYSIS
```

MODE	1	2	3	4	5
FREQ HZ	7.6648E-03	7.6648E-03	7.7085E-03	9.2003E-03	4.3441E-01
RAD/S	4.8159E-02	4.8159E-02	4.8434E-02	5.7807E-02	2.7295E+00
GEN MASS	2.1558E+03	2.1558E+03	4.5320E+03	4.5320E+03	9.4230E-01
SYS DOF					
PH 1000	1.0000	0.0000	0.0000	0.0000	0.0000
YW 1000	0.0000	1.0000	0.0000	0.0000	0.0000
YC 2000	0.0000	0.0000	0.0012	0.0031	0.1753
					MORE...
ZC 2000	0.0000	0.0000	-0.0009	-0.0011	-0.4948
PH 2000	0.0000	0.0000	-0.1756	-1.0000	0.0064
YW 2000	0.0000	0.0000	-1.0000	0.1756	0.0023
YC 3000	0.0000	0.0000	-0.0015	-0.0003	-0.3540
ZC 3000	0.0000	0.0000	0.0000	-0.0003	1.0000
PH 3000	0.0000	0.0000	0.1756	1.0000	0.0062
YW 3000	0.0000	0.0000	1.0000	-0.1755	0.0022

MODE	6	7	8	9	10
FREQ HZ	4.3482E-01	5.1521E-01	5.1531E-01	4.6080E+00	9.4498E+00
RAD/S	2.7321E+00	3.2372E+00	3.2378E+00	2.8953E+01	5.9375E+01
GEN MASS	9.3693E-01	6.9514E-01	6.9242E-01	3.8846E+00	4.9496E+00
SYS DOF					
PH 1000	0.0000	0.0000	0.0000	0.0000	0.0000
YW 1000	0.0000	0.0000	0.0000	0.0000	0.0000
YC 2000	-0.4922	-0.4104	1.0000	-0.3448	1.0000
ZC 2000	-0.1742	1.0000	0.4103	1.0000	0.3443
					MORE...
PH 2000	0.0022	-0.0022	-0.0009	0.0241	0.0084
YW 2000	-0.0064	-0.0009	0.0022	0.0083	-0.0243
YC 3000	1.0000	-0.2035	0.4924	0.2710	-0.7877
ZC 3000	0.3541	0.4963	0.2021	-0.7859	-0.2712
PH 3000	0.0022	-0.0021	-0.0009	0.0231	0.0081
YW 3000	-0.0061	-0.0009	0.0021	0.0080	-0.0234

2.6.2 <u>ACAP Ground Resonance Simulation - Blade Damage</u>. The purpose of this analysis was to evaluate the effect of blade damage on the stability of the ACAP (Advanced Composite Airframe Program) helicopter. Inertia and stiffness properties for a 4-bladed rotor were chosen so that the blade lead-lag frequency exceeds the rotation frequency of the rotor, resulting in an unstable system above a critical rotor RPM. Coupled to the rotor is a representation of the Sikorsky S-75 fuselage and landing gear as shown in Figures 14 and 15. The fuselage is modeled with rigid body degrees of freedom only. The landing gear is a tricycle type with the two main gears connected through a piston, spring, and damper which act to couple the roll and lateral degrees of freedom of the gear (teetering hydraulic system).

Ballistic damage to the rotor blades was simulated by inertia and stiffness reductions in the original rotor component data set and by introducing a rotor damage component data set in the original model (Figure 16).

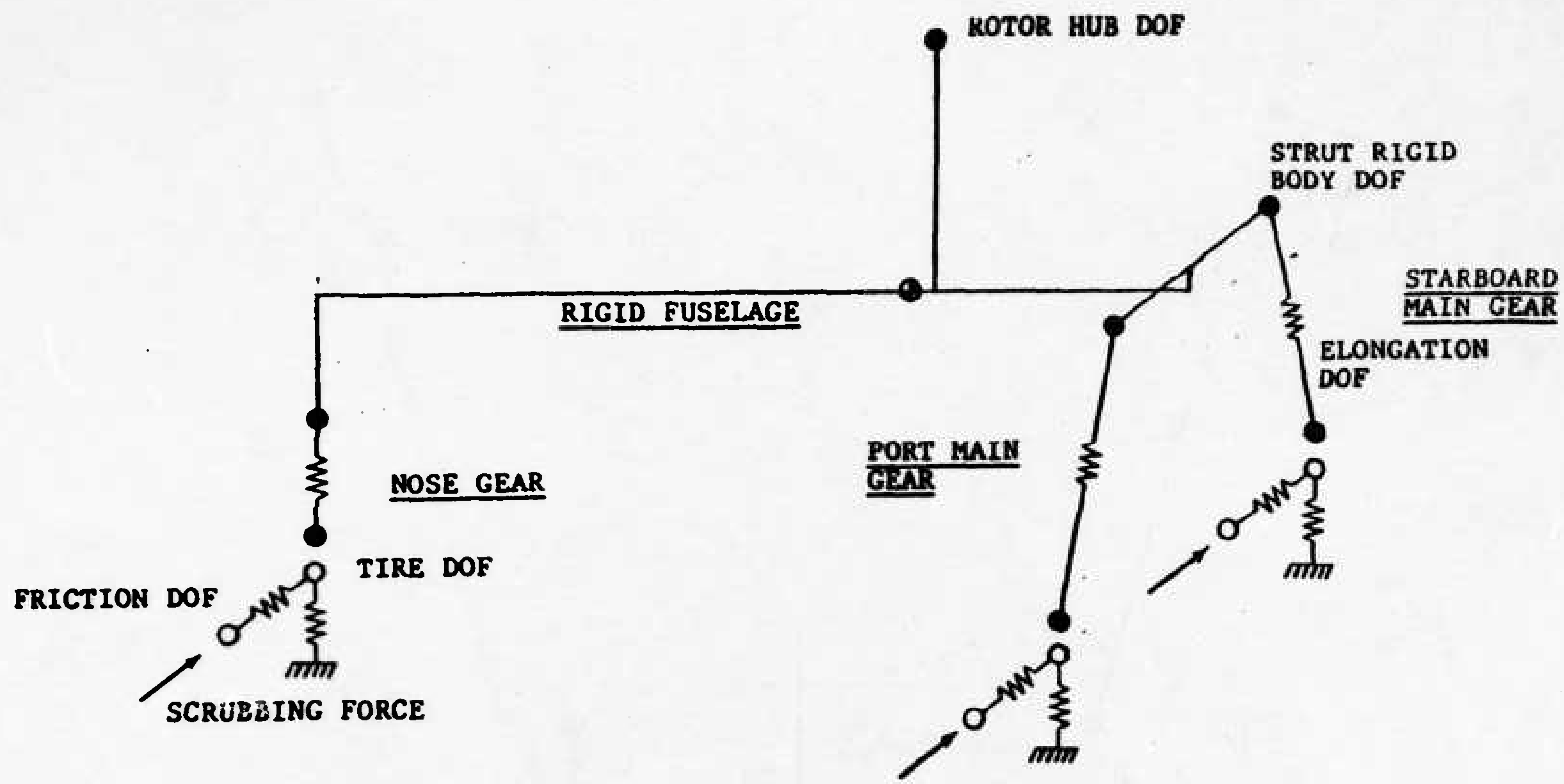

Figure 14. ACAP Fuselage and Landing Gear.

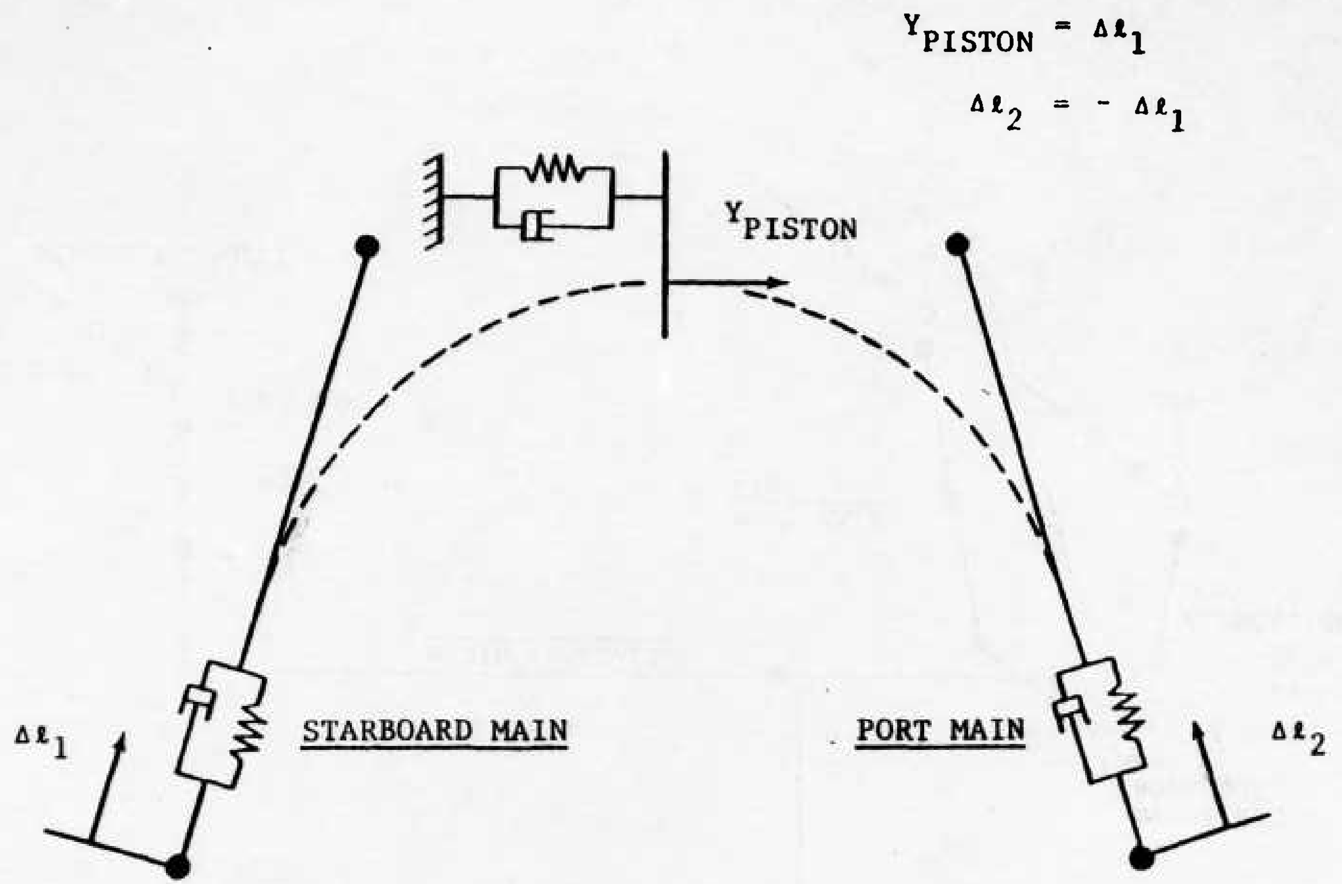

Figure 15. Coupled Main Landing Gear - Teetering Hydraulic System.

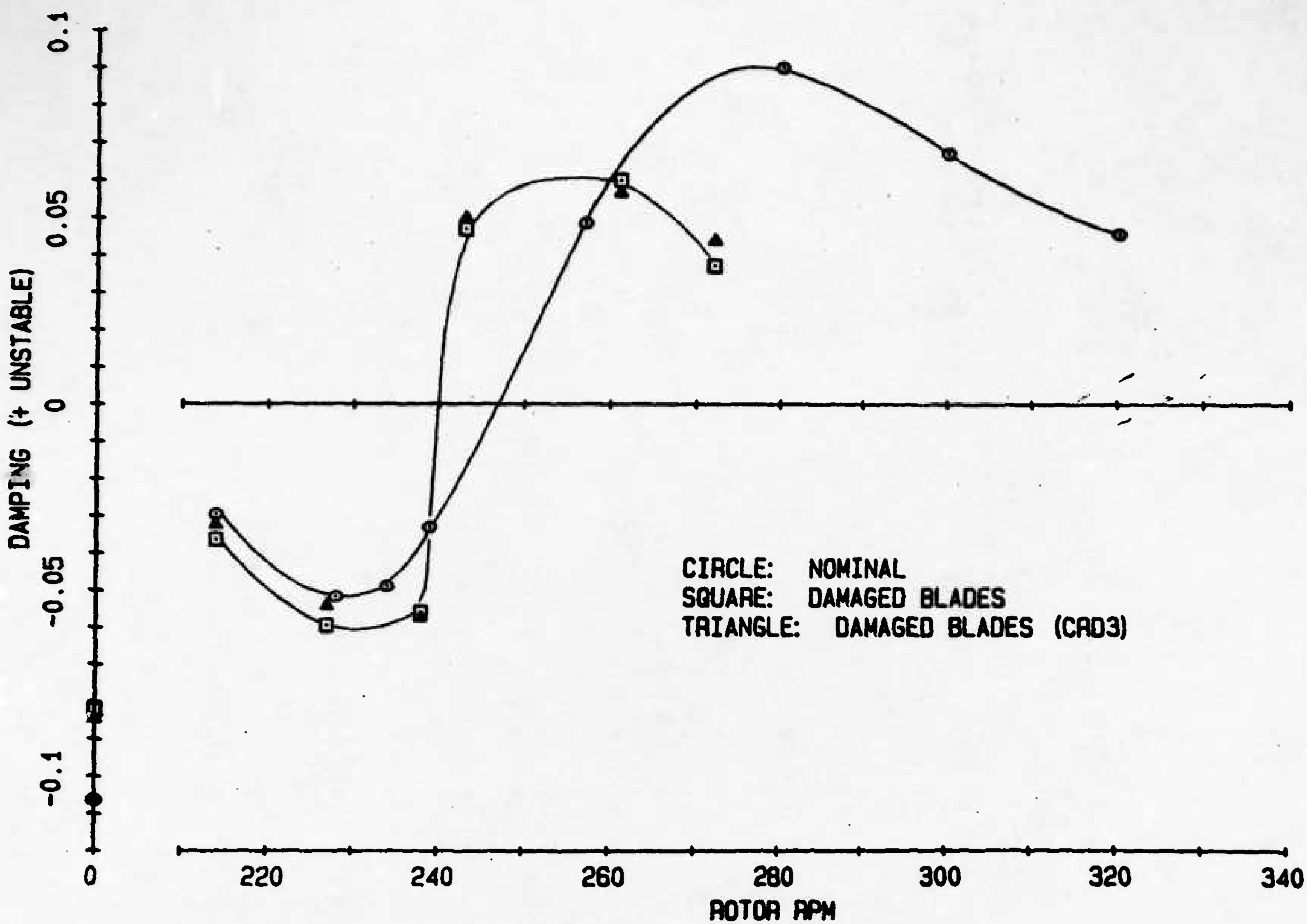

Figure 16. ACAP Ground Resonance Stability.

```
LIST
DATA SET
ACAPFUS
DATA MEMBER
CFM3
ACAPFUS /CFM3      ON FILE U1

***************        ACAPFUS /CFM3       ***************

RIGID ACAP FUSELAGE

*******************************************************************
INPUT FOR STRUCTURAL      COMPONENT CFM3. 3-D MODAL FUSELAGE

  1 RBM        - RIGID BODY MODES     =          YES
  2 IXCG       - LONGITUDINAL         =          NO
  3 IYCG       - LATERAL              =          YES
  4 IZCG       - VERTICAL             =          NO
  5 IROLL      - ROLL                 =          YES
  6 IPTCH      - PITCH                =          NO
  7 IYAW       - YAW                  =          NO
                                                               MORE...
  8 CG         - (REAL) XYZ CG LOCATION (IN)
               1.93000E+02  0.00000E+00  9.68000E+01
  9 NS         - NO. OF NODAL POINTS =             7
 10 XYZNS      - (REAL) XYZ FOR EACH NODE
             GENERAL MATRIX

    ROW    1
            2.00000E+02  5.40000E+01  2.61000E+02  2.61000E+02
            2.61000E+02  2.61000E+02  2.61000E+02
    ROW    2
            0.00000E+00  0.00000E+00 -3.02500E+01 -1.10000E+01
            3.02500E+01  1.10000E+01  0.00000E+00
    ROW    3
            1.57000E+02  6.30000E+01  9.95000E+01  6.30000E+01
            9.95000E+01  6.30000E+01  9.95000E+01
 11 NMODE       - NO. OF ELASTIC MODES=            0
 12 NODOF       - DOF Y OR N FOR NODES
ROW      1
             NO  NO  NO  NO  NO  NO  NO
ROW      2
             YES YES YES YES YES YES YES
ROW      3
                                                               MORE...
```

```
             NO   NO   YES  YES  YES  YES  NO
ROW       4
             YES  YES  YES  NO   YES  NO   NO
ROW       5
             NO   NO   NO   NO   NO   NO   NO
ROW       6
             NO   NO   NO   NO   NO   NO   NO
 13 XYZD       - (REAL) LOCAL X,Y VECTORS
             GENERAL MATRIX

   ROW     1
          1.00000E+00  1.00000E+00  1.00000E+00  1.00000E+00
          1.00000E+00  1.00000E+00  1.00000E+00
   ROW     2      NULL ROW
   ROW     3      NULL ROW
   ROW     4      NULL ROW
   ROW     5
          1.00000E+00  1.00000E+00  9.61600E-01  5.45900E-01
          9.61600E-01  5.45900E-01  1.00000E+00
   ROW     6
          0.00000E+00  0.00000E+00 -2.74300E-01 -8.37900E-01
          2.74300E-01  8.37900E-01  0.00000E+00
                                                           MORE...
 14 MASSL      - FUSELAGE MASS  (LB) =  8.47000E+03
 15 IMXX       - ROLL MOI SLUG-FT(SQ)=  2.47608E+03
*************************************************************************
```

```
LIST
DATA SET
ACAPSTAR
DATA MEMBER
CLG2
ACAPSTAR/CLG2      ON FILE U1


***************       ACAPSTAR/CLG2       ***************

STARBOARD MAIN GEAR STRUT

**************************************************************
INPUT FOR STRUCTURAL     COMPONENT CLG2. LANDING GEAR

   1 NAMEZS    - STRUT Z-TRANSLATION =     TRAZ1030
   2 NAMEXS    - STRUT X-TRANSLATION =     TRAX1030
   3 NAMEYS    - STRUT Y-TRANSLATION =     TRAY1030
   4 NAMEAX    - STRUT X-ROTATION    =     ROTX1030
   5 NAMEAY    - STRUT Y-ROTATION    =     ROTY1030
   6 NAMEDL    - STRUT ELONGATION    =     LSTR1030
   7 M1        - TIRE MASS           =  2.50000E-01
                                                          MORE...
   8 M2        - STRUT MASS          =  1.00000E-01
   9 L0        - UNDEFORMED LENGTH   =  6.48900E+01
  10 ZCOS      - (REAL) STRUT Z-TRAN DIR COS
               0.00000E+00  2.74300E-01  9.61600E-01
  11 XCOS      - (REAL) STRUT X-TRAN DIR COS
               1.00000E+00  0.00000E+00  0.00000E+00
  12 NKL       - NO. OF DEF POINTS   =            2
  13 COEFKLSL  - STRUT DISPLACEMENT  = -1.00000E+01  1.00000E+01
  14 COEFKLSR  - STRUT SPRING RATE   =  7.20000E+02  7.20000E+02
  15 NCL       - NO. OF DEF POINTS   =            2
  16 COEFCLV   - STRUT VELOCITY      = -1.00000E+02  1.00000E+02
  17 COEFCLDR  - STRUT DAMPING RATE  =  0.00000E+00  0.00000E+00
  18 NKX       - NO. OF DEF POINTS   =            2
  19 COEFKXLD  - TIRE LONG DISPLACEMT= -1.00000E+01  1.00000E+01
  20 COEFKXSR  - TIRE SPRING RATE    =  1.50300E+03  1.50300E+03
  21 NCX       - NO. OF DEF POINTS   =            2
  22 COEFCXV   - TIRE LONG VELOCITY  = -1.00000E+02  1.00000E+02
  23 COEFCXDR  - TIRE DAMPING RATE   =  1.50000E+01  1.50000E+01
  24 NKY       - NO. OF DEF POINTS   =            2
  25 COEFKYLD  - TIRE LAT DISPLACEMT = -1.00000E+01  1.00000E+01
  26 COEFKYSR  - TIRE SPRING RATE    =  1.39100E+03  1.39100E+03
  27 NCY       - NO. OF DEF POINTS   =            2
                                                          MORE...
```

```
 28 COEFCYV   - TIRE LAT VELOCITY    = -1.00000E+02  1.00000E+02
 29 COEFCYDR  - TIRE DAMPING RATE    =  1.50000E+01  1.50000E+01
 30 NKZ       - NO. OF DEF POINTS    =            2
 31 COEFKZVD  - TIRE VERT DISPLACEMT= -1.00000E+01  1.00000E+01
 32 COEFKZSR  - TIRE SPRING RATE     =  2.92300E+03  2.92300E+03
 33 NCZ       - NO. OF DEF POINTS    =            2
 34 COEFCZV   - TIRE VERT VELOCITY   = -1.00000E+02  1.00000E+02
 35 COEFCZDR  - TIRE DAMPING RATE    =  1.50000E+01  1.50000E+01
 36 FRIC      - GROUND FRICTION      =          YES
 37 BRAKE     - BRAKES ON            =           NO
 38 SCOX      - LONG SCRUBBING COEFF=  3.24720E+01
 39 SCOY      - LAT SCRUBBING COEFF =  4.87090E+01
*********************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
ACAPPORT
DATA MEMBER
CLG2
ACAPPORT/CLG2      ON FILE U1

***************    ACAPPORT/CLG2      ***************

PORT MAIN GEAR STRUT

*******************************************************************
INPUT FOR STRUCTURAL     COMPONENT CLG2. LANDING GEAR

  1 NAMEZS    - STRUT Z-TRANSLATION =     TRAZ1050
  2 NAMEXS    - STRUT X-TRANSLATION =     TRAX1050
  3 NAMEYS    - STRUT Y-TRANSLATION =     TRAY1050
  4 NAMEAX    - STRUT X-ROTATION    =     ROTX1050
  5 NAMEAY    - STRUT Y-ROTATION    =     ROTY1050
  6 NAMEDL    - STRUT ELONGATION    =     LPRT1050
  7 M1        - TIRE MASS           =  2.50000E-01
                                                          MORE...
  8 M2        - STRUT MASS          =  1.00000E-01
  9 L0        - UNDEFORMED LENGTH   =  6.48900E+01
 10 ZCOS      - (REAL) STRUT Z-TRAN DIR COS
              0.00000E+00 -2.74300E-01  9.61600E-01
 11 XCOS      - (REAL) STRUT X-TRAN DIR COS
               1.00000E+00  0.00000E+00  0.00000E+00
 12 NKL       - NO. OF DEF POINTS   =            2
 13 COEFKLSL  - STRUT DISPLACEMENT  = -1.00000E+01  1.00000E+01
 14 COEFKLSR  - STRUT SPRING RATE   =  7.20000E+02  7.20000E+02
 15 NCL       - NO. OF DEF POINTS   =            2
 16 COEFCLV   - STRUT VELOCITY      = -1.00000E+02  1.00000E+02
 17 COEFCLDR  - STRUT DAMPING RATE  =  0.00000E+00  0.00000E+00
 18 NKX       - NO. OF DEF POINTS   =            2
 19 COEFKXLD  - TIRE LONG DISPLACEMT= -1.00000E+01  1.00000E+01
 20 COEFKXSR  - TIRE SPRING RATE    =  1.50300E+03  1.50300E+03
 21 NCX       - NO. OF DEF POINTS   =            2
 22 COEFCXV   - TIRE LONG VELOCITY  = -1.00000E+02  1.00000E+02
 23 COEFCXDR  - TIRE DAMPING RATE   =  1.50000E+01  1.50000E+01
 24 NKY       - NO. OF DEF POINTS   =            2
 25 COEFKYLD  - TIRE LAT DISPLACEMT = -1.00000E+01  1.00000E+01
 26 COEFKYSR  - TIRE SPRING RATE    =  1.39100E+03  1.39100E+03
 27 NCY       - NO. OF DEF POINTS   =            2
                                                          MORE...
```

```
28 COEFCYV   - TIRE LAT VELOCITY    = -1.00000E+02  1.00000E+02
29 COEFCYDR  - TIRE DAMPING RATE    =  1.50000E+01  1.50000E+01
30 NKZ       - NO. OF DEF POINTS    =            2
31 COEFKZVD  - TIRE VERT DISPLACEMT= -1.00000E+01  1.00000E+01
32 COEFKZSR  - TIRE SPRING RATE     =  2.92300E+03  2.92300E+03
33 NCZ       - NO. OF DEF POINTS    =            2
34 COEFCZV   - TIRE VERT VELOCITY   = -1.00000E+02  1.00000E+02
35 COEFCZDR  - TIRE DAMPING RATE    =  1.50000E+01  1.50000E+01
36 FRIC      - GROUND FRICTION      =          YES
37 BRAKE     - BRAKES ON            =          NO
38 SCOX      - LONG SCRUBBING COEFF=  3.24720E+01
39 SCOY      - LAT SCRUBBING COEFF =  4.87090E+01
*******************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
ACAPAUX
DATA MEMBER
CLG2
ACAPAUX /CLG2      ON FILE U1

***************       ACAPAUX /CLG2      ***************

AUXILIARY (NOSE GEAR) STRUT

*******************************************************************
INPUT FOR STRUCTURAL     COMPONENT CLG2. LANDING GEAR

  1 NAMEZS    - STRUT Z-TRANSLATION =     TRAZ1020
  2 NAMEXS    - STRUT X-TRANSLATION =     TRAX1020
  3 NAMEYS    - STRUT Y-TRANSLATION =     TRAY1020
  4 NAMEAX    - STRUT X-ROTATION    =     ROTX1020
  5 NAMEAY    - STRUT Y-ROTATION    =     ROTY1020
  6 NAMEDL    - STRUT ELONGATION    =     LAUX1020
  7 M1        - TIRE MASS           =  2.50000E-01
                                                            MORE...
  8 M2        - STRUT MASS          =  1.00000E-01
  9 L0        - UNDEFORMED LENGTH   =  2.59000E+01
 10 ZCOS      - (REAL) STRUT Z-TRAN DIR COS
              0.00000E+00  0.00000E+00  1.00000E+00
 11 XCOS      - (REAL) STRUT X-TRAN DIR COS
              1.00000E+00  0.00000E+00  0.00000E+00
 12 NKL       - NO. OF DEF POINTS   =            2
 13 COEFKLSL  - STRUT DISPLACEMENT  = -1.00000E+01  1.00000E+01
 14 COEFKLSR  - STRUT SPRING RATE   =  7.05820E+02  7.05820E+02
 15 NCL       - NO. OF DEF POINTS   =            2
 16 COEFCLV   - STRUT VELOCITY      = -1.00000E+02  1.00000E+02
 17 COEFCLDR  - STRUT DAMPING RATE  =  1.00000E+01  1.00000E+01
 18 NKX       - NO. OF DEF POINTS   =            2
 19 COEFKXLD  - TIRE LONG DISPLACEMT= -1.00000E+01  1.00000E+01
 20 COEFKXSR  - TIRE SPRING RATE    =  1.50300E+03  1.50300E+03
 21 NCX       - NO. OF DEF POINTS   =            2
 22 COEFCXV   - TIRE LONG VELOCITY  = -1.00000E+02  1.00000E+02
 23 COEFCXDR  - TIRE DAMPING RATE   =  1.50000E+01  1.50000E+01
 24 NKY       - NO. OF DEF POINTS   =            2
 25 COEFKYLD  - TIRE LAT DISPLACEMT = -1.00000E+01  1.00000E+01
 26 COEFKYSR  - TIRE SPRING RATE    =  1.39100E+03  1.39100E+03
 27 NCY       - NO. OF DEF POINTS   =            2
                                                            MORE...
```

```
28 COEFCYV   - TIRE LAT VELOCITY    = -1.00000E+02  1.00000E+02
29 COEFCYDR  - TIRE DAMPING RATE    =  1.50000E+01  1.50000E+01
30 NKZ       - NO. OF DEF POINTS    =            2
31 COEFKZVD  - TIRE VERT DISPLACEMT= -1.00000E+01  1.00000E+01
32 COEFKZSR  - TIRE SPRING RATE     =  2.92300E+03  2.92300E+03
33 NCZ       - NO. OF DEF POINTS    =            2
34 COEFCZV   - TIRE VERT VELOCITY   = -1.00000E+02  1.00000E+02
35 COEFCZDR  - TIRE DAMPING RATE    =  1.50000E+01  1.50000E+01
36 FRIC      - GROUND FRICTION      =          YES
37 BRAKE     - BRAKES ON            =          NO
38 SCOX      - LONG SCRUBBING COEFF=  3.18320E+01
39 SCOY      - LAT SCRUBBING COEFF =  4.77480E+01
*************************************************************************

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
GRR
DATA MEMBER
CRE3
GRR      /CRE3      ON FILE U1

***************      GRR      /CRE3      ***************

STIFF INPLANE ROTOR FOR GROUND RESONANCE

************************************************************************
INPUT FOR      ROTOR      COMPONENT CRE3. ROTOR ELASTIC BLADES

  1 JV        - INPLANE DOF           =        YES
  2 JW        - OUTPLANE DOF          =        NO
  3 JP        - TORSION DOF           =        NO
  4 JS        - SHAFT PERTURBED DOF   =        NO
  5 JX        - XHUB(LONG) DOF        =        NO
  6 JY        - YHUB(LAT) DOF         =        YES
  7 JZ        - ZHUB(AXIAL) DOF       =        NO
                                                               MORE...
  8 JAX       - ALFX(ROLL) DOF        =        YES
  9 JAY       - ALFY(PTCH) DOF        =        NO
 10 JAZ       - ALFZ(YAW) DOF         =        NO
 11 NV        - NO. OF INPLANE MODES=            1
 12 NB        - NO. OF BLADES         =            4
 13 NX        - NO. OF STATIONS       =           13
 14 ITYP      - MODE INPUT 1 OR 2     =            2
 15 X         - (REAL) STATIONS
               0.00000E+00  2.00000E+01  4.00000E+01  6.00000E+01
               8.00000E+01  1.00000E+02  1.20000E+02  1.40000E+02
               1.60000E+02  1.80000E+02  2.00000E+02  2.20000E+02
               2.40000E+02
 16 NIP       - INPLANE HINGE STA     =            1
 17 CIPP      - IP MODAL DAMPING      =  2.50000E-01
 18 IBIP      - IP BC 1 OR 2          =            2
 19 NI        - NO. OF IMPLICIT DOFS=              0
 20 KIP       - IP SPRING RATE        =  5.58000E+08
 21 CIP       - IP DAMPING RATE       =  0.00000E+00
 22 OM        - RPM                   =  3.00000E+02
 23 IC        - ROTATION DIRECTION    =            1
 24 PSI0      - AZIMUTH OF REF BLADE=    0.00000E+00
 25 MHUB      - HUB WEIGHT (LB)       =  0.00000E+00
                                                               MORE...
```

```
26 IHUBX     - HUB M.O.I. ABOUT X- =  0.00000E+00
27 TH0       - ROOT PTCH ANG (DEG) =  0.00000E+00
28 NONLIN    - NONLIN TERMS        =          NO
29 IU        - UNIFORM BLADE       =         YES
30 M0        - UNIFORM MASS DENSITY=  7.50000E-01
31 SE0       - UNIFORM CG OFFSET   =  0.00000E+00
32 SEA0      - UNIFORM AC OFFSET   =  0.00000E+00
33 KM10      - UNIFORM MASS ROG    =  0.00000E+00
34 KM20      - UNIFORM MASS ROG    =  6.00000E+00
35 KA0       - UNIFORM AREA ROG    =  6.00000E+00
36 THP0      - UNIFRM PRETWIST RATE=  0.00000E+00
37 EIY0      - UNIFORM CHORDWISE EI=  5.55800E+02
38 EA0       - UNIFORM SEC EA*10E-6=  2.00000E+01
39 EIZ0      - UNIFORM  BEAMWISE EI=  1.65000E+02
40 JIL       - INTERNAL LOADS      =          NO
*********************************************************************

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
CROT
DATA MEMBER
CLC1
CROT    /CLC1     ON FILE U1

***************      CROT    /CLC1      ***************

COUPLE ROTOR HUB, FUSELAGE DOF

**************************************************************************
INPUT FOR COMPONENT CLC1. LINEAR CONSTRAINTS

   1 NCDF      - NUMBER OF DOF         =          2
   2 CDFLI     - DOF NAMES             =     TRAY1010      ROTX1010
   3 NCIDF     - # OF CONSTRAINT EQNS=              2
   4 CIDFLI    - IMPLICIT DOF NAMES   =     YHUB1000      ALFX1000
   5 COEF      - (REAL) COEFFICIENT MATRIX
            DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

                                                              MORE...
      1.00000E+00  1.00000E+00
**************************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
PISTON
DATA MEMBER
CSF1
PISTON  /CSF1      ON FILE U1

***************        PISTON   /CSF1       ***************

CENTERING PISTON FOR MAIN GEAR CROSS-TIE

*********************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF       - NUMBER OF DOF         =           1
  2 CDFLI      - DOF NAMES             =      YP  1000
  3 CM         - (REAL) MASS MATRIX
           DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

     1.00000E-01
  4 CC         - (REAL) DAMPING MATRIX
                                                             MORE...
           DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

     2.00000E+01
  5 CK         - (REAL) STIFFNESS MATRIX
           DIAGONAL MATRIX (DIAGONAL VALUES PRINTED)

     2.00000E+03
  6 CF         - FORCE VECTOR          =  0.00000E+00
*********************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
CROSSTIE
DATA MEMBER
CLC1
CROSSTIE/CLC1      ON FILE U1

***************       CROSSTIE/CLC1      ***************

CONSTRAINTS FOR MAIN GEAR HYDRAULIC CROSSTIE

***********************************************************************
INPUT FOR COMPONENT CLC1. LINEAR CONSTRAINTS

  1 NCDF      - NUMBER OF DOF          =         1
  2 CDFLI     - DOF NAMES              =    LSTR1030
  3 NCIDF     - # OF CONSTRAINT EQNS=            2
  4 CIDFLI    - IMPLICIT DOF NAMES  =    LPRT1050      YP   1000
  5 COEF      - (REAL) COEFFICIENT MATRIX
           GENERAL MATRIX

                                                              MORE...
    ROW     1
        -1.00000E+00
    ROW     2
         1.00000E+00
***********************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
LOCKG
DATA MEMBER
CLC1
LOCKG    /CLC1      ON FILE U1


***************      LOCKG    /CLC1      ***************

LANDING GEAR CONSTRAINTS

*******************************************************************
INPUT FOR COMPONENT CLC1. LINEAR CONSTRAINTS

  1 NCDF     - NUMBER OF DOF          =          1
  2 CDFLI    - DOF NAMES              =     RL  1000
  3 NCIDF    - ‡ OF CONSTRAINT EQNS=             8
  4 CIDFLI   - (DOF) IMPLICIT DOF NAMES
           TRAZ1020  LAUX1020  TRAX1020  TRAX1030  TRAX1050
           ROTY1020  ROTY1030  ROTY1050
  5 COEF     - (REAL) COEFFICIENT MATRIX
                                                          MORE...
           NULL MATRIX
*******************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
LOCKT
DATA MEMBER
CLC1
LOCKT   /CLC1      ON FILE U1

***************       LOCKT   /CLC1       ***************

TIRE CONSTRAINTS

*******************************************************************
INPUT FOR COMPONENT CLC1. LINEAR CONSTRAINTS

 1 NCDF      - NUMBER OF DOF         =             1
 2 CDFLI     - DOF NAMES             =       RL  1000
 3 NCIDF     - # OF CONSTRAINT EQNS=               4
 4 CIDFLI    - (DOF) IMPLICIT DOF NAMES
           TIRE2010  TIRE3010  TIRE4010  TIRE4030
 5 COEF      - (REAL) COEFFICIENT MATRIX
            NULL MATRIX
                                                           MORE...

*******************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
LOCKF
DATA MEMBER
CLC1
LOCKF    /CLC1      ON FILE U1


***************       LOCKF    /CLC1       ***************

ELIMINATE FRICTION DOF

********************************************************************
INPUT FOR COMPONENT CLC1. LINEAR CONSTRAINTS

  1 NCDF      - NUMBER OF DOF        =            1
  2 CDFLI     - DOF NAMES            =      RL 1000
  3 NCIDF     - # OF CONSTRAINT EQNS=             3
  4 CIDFLI    - (DOF) IMPLICIT DOF NAMES
           FRCY2000  FRCY3000  FRCY4000
  5 COEF      - (REAL) COEFFICIENT MATRIX
           NULL MATRIX
                                                              MORE...

********************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
TIRE
DATA MEMBER
CSF1
TIRE     /CSF1      ON FILE U1

***************        TIRE    /CSF1        ***************

TIRE DOF

*********************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF      - NUMBER OF DOF        =            9
  2 CDFLI     - (DOF) DOF NAMES
           TIRE2010  TIRE2020  TIRE2030  TIRE3010  TIRE3020
           TIRE3030  TIRE4010  TIRE4020  TIRE4030
  3 CM        - (REAL) MASS MATRIX
           NULL MATRIX

                                                          MORE...
  4 CC        - (REAL) DAMPING MATRIX
           NULL MATRIX

  5 CK        - (REAL) STIFFNESS MATRIX
           NULL MATRIX

  6 CF        - (REAL) FORCE VECTOR
            0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
            0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
            0.00000E+00
*********************************************************************

LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
AFM
DATA MEMBER
CSF1
AFM      /CSF1      ON FILE U1

***************        AFM      /CSF1        ***************

AUXILIARY FUSELAGE ATTACH POINTS

*******************************************************************
INPUT FOR COMPONENT CSF1. FINITE ELEMENT

  1 NCDF      - NUMBER OF DOF          =            5
  2 CDFLI     - (DOF) DOF NAMES
            TRAY1040  TRAZ1040  TRAY1060  TRAZ1060  TRAY1070
  3 CM        - (REAL) MASS MATRIX
            NULL MATRIX

  4 CC        - (REAL) DAMPING MATRIX
                                                              MORE...
            NULL MATRIX

  5 CK        - (REAL) STIFFNESS MATRIX
            NULL MATRIX

  6 CF        - (REAL) FORCE VECTOR
              0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00
*******************************************************************

LIST COMPLETE
COMMAND
```

```
RUN
MODEL NAME (DATA SET)
ACAPF
LIST MODEL SUMMARY (Y OR N)
Y

***********************      MODEL ACAPF      ********************

ACAP WITH FRICTION DOF ELIMINATED

INDEX   COMP   NO.   DATA SET      FORCE   DATA SET

  1     CLC1         LOCKG         NONE
  2     CLC1         LOCKT         NONE
  3     CFM3    1    ACAPFUS       NONE
  4     CLG2    2    ACAPSTAR      NONE
  5     CLG2    3    ACAPPORT      NONE
  6     CLG2    4    ACAPAUX       NONE
  7     CSF1         TIRE          NONE
  8     CSF1         AFM           NONE
  9     CSF1         PISTON        NONE
                                                      MORE...
 10     CLC1         CROSSTIE      NONE
 11     CRE3    1    GRR           NONE
 12     CLC1         CROT          NONE
 13     CLC1         LOCKF         NONE

******************************************************************

******************************************************************
                      GLOBAL  VARIABLES

 NO INPUT REQUIRED
******************************************************************


TEMPORARY RUN EDIT OF ANY COMPONENT/FORCE INPUT (Y OR N)
N
******************************************************************
DETAILS (Y OR N)
Y

                                                      MORE...
```

```
*****************************************************************************
                    COMPONENT DOF/SYSTEM DOF
             1, 6        2, 7        3, 8        4, 9        5, 10

 1  CLC1    RL   1000
            (    1)

 2  CLC1    RL   1000
            (    1)

 3  CFM3    YC   1000    RL   1000
            (    2)      (    1)

 4  CLG2    TRAX1030     TRAY1030    TRAZ1030    ROTX1030    ROTY1030
            LSTR1030     FRCY2000
            (    0)      (   -1)     (   -3)     (   -5)     (    0)
            (    3)      (    0)

 5  CLG2    TRAX1050     TRAY1050    TRAZ1050    ROTX1050    ROTY1050
            LPRT1050     FRCY3000
            (    0)      (   -6)     (   -8)     (  -10)     (    0)
                                                             MORE...
            (  -11)      (    0)

 6  CLG2    TRAX1020     TRAY1020    TRAZ1020    ROTX1020    ROTY1020
            LAUX1020     FRCY4000
            (    0)      (  -12)     (    0)     (  -14)     (    0)
            (    0)      (    0)

 7  CSF1    TIRE2010     TIRE2020    TIRE2030    TIRE3010    TIRE3020
            TIRE3030     TIRE4010    TIRE4020    TIRE4030
            (    0)      (  -15)     (  -21)     (    0)     (  -27)
            (  -33)      (    0)     (  -39)     (    0)

 8  CSF1    TRAY1040     TRAZ1040    TRAY1060    TRAZ1060    TRAY1070

            (  -42)      (  -44)     (  -46)     (  -48)     (  -50)

 9  CSF1    YP   1000
            (  -52)

10  CLC1    LSTR1030
            (    3)

                                                             MORE...
```

```
11  CRE3     IP   1110     IP   1210     IP   1310     IP   1410     YHUB1000
             ALFX1000
             (    4)       (    5)       (    6)       (    7)       ( -53)
             ( -55)

12  CLC1     TRAY1010      ROTX1010
             ( -56)        ( -58)

13  CLC1     RL   1000
             (    1)
```

SYSTEM DOF

```
         1     RL   1000
         2     YC   1000
         3     LSTR1030
         4     IP   1110
         5     IP   1210
         6     IP   1310
         7     IP   1410
```

MORE...

IMPLICIT COEFFICIENTS

I	COEF	DOF	I	COEF	DOF
1	9.616E-01	YC 1000	30	-8.182E+00	RL 1000
2	5.701E+00	*RL 1000	31	6.240E+01	RL 1000
3	2.743E-01	YC 1000	32	2.743E-01	*LSTR1030
4	-2.983E+01	*RL 1000	33	2.638E-01	YC 1000
5	1.000E+00	*RL 1000	34	1.564E+00	RL 1000
6	9.616E-01	YC 1000	35	-2.638E-01	YC 1000
7	5.701E+00	*RL 1000	36	2.868E+01	RL 1000
8	-2.743E-01	YC 1000	37	1.780E+01	RL 1000
9	2.983E+01	*RL 1000	38	-9.616E-01	*LSTR1030
10	1.000E+00	*RL 1000	39	1.000E+00	YC 1000
11	-1.000E+00	*LSTR1030	40	3.380E+01	RL 1000
12	1.000E+00	YC 1000	41	2.590E+01	*RL 1000
13	3.380E+01	*RL 1000	42	5.459E-01	YC 1000
14	1.000E+00	*RL 1000	43	2.767E+01	*RL 1000
15	2.743E-01	LSTR1030	44	8.379E-01	YC 1000
16	9.247E-01	YC 1000	45	2.232E+01	*RL 1000
17	5.483E+00	RL 1000	46	5.459E-01	YC 1000

MORE...

18	7.524E-02	YC	1000	47	2.767E+01	*RL	1000
19	-8.182E+00	RL	1000	48	-8.379E-01	YC	1000
20	6.240E+01	*RL	1000	49	-2.232E+01	*RL	1000
21	9.616E-01	LSTR	1030	50	1.000E+00	YC	1000
22	-2.638E-01	YC	1000	51	-2.700E+00	*RL	1000
23	-1.564E+00	RL	1000	52	1.000E+00	*LSTR	1030
24	2.638E-01	YC	1000	53	1.000E+00	YC	1000
25	-2.868E+01	RL	1000	54	-6.020E+01	*RL	1000
26	-1.780E+01	*RL	1000	55	1.000E+00	*RL	1000
27	9.247E-01	YC	1000	56	1.000E+00	YC	1000
28	5.483E+00	RL	1000	57	-6.020E+01	*RL	1000
29	7.524E-02	YC	1000	58	1.000E+00	*RL	1000

```
PRINT MATRICES (Y OR N)
N
************************************************************************
SOLUTION OR N
```

```
***************** SOLUTION SSF3 FOR MODEL ACAFF   *****************
MODEL    - ACAP WITH FRICTION DOF ELIMINATED
SOLUTION - STABILITY FLOQUET

*******************************************************************

    THIS MODEL WAS EDITED AT RUN TIME  (300 RPM)

*******************************************************************

             FREQUENCY          DAMPING

             115.67746         -42.04611
            -115.67746         -42.04611
              13.83969          -0.83117
             -13.83972          -0.83124
               2.36125           0.06715
                                                      MORE...
              -2.36125           0.06715
              35.81461          -1.06139
             -35.81470          -1.06146
              35.26747          -0.96586
             -35.26744          -0.96582
              35.28421          -1.06926
             -35.28419          -1.06928
              35.28036          -1.06570
             -35.28035          -1.06572
*******************************************************************
COMMAND
```

```
LIST
DATA SET
GRRD
DATA MEMBER
CRE3
GRRD    /CRE3     ON FILE U1

***************        GRRD    /CRE3       ***************

DAMAGED GROUND RESONANCE ROTOR

**********************************************************************
INPUT FOR      ROTOR      COMPONENT CRE3. ROTOR ELASTIC BLADES

  1 JV        - INPLANE DOF            =          YES
  2 JW        - OUTPLANE DOF           =          NO
  3 JP        - TORSION DOF            =          NO
  4 JS        - SHAFT PERTURBED DOF    =          NO
  5 JX        - XHUB(LONG) DOF         =          NO
  6 JY        - YHUB(LAT) DOF          =          YES
  7 JZ        - ZHUB(AXIAL) DOF        =          NO
                                                                 MORE...
  8 JAX       - ALFX(ROLL) DOF         =          YES
  9 JAY       - ALFY(PTCH) DOF         =          NO
 10 JAZ       - ALFZ(YAW) DOF          =          NO
 11 NV        - NO. OF INPLANE MODES=                1
 12 NB        - NO. OF BLADES          =               4
 13 NX        - NO. OF STATIONS        =              13
 14 ITYP      - MODE INPUT 1 OR 2      =               2
 15 X         - (REAL) STATIONS
              0.00000E+00  2.00000E+01  4.00000E+01  6.00000E+01
              8.00000E+01  1.00000E+02  1.20000E+02  1.40000E+02
              1.60000E+02  1.80000E+02  2.00000E+02  2.20000E+02
              2.40000E+02
 16 NIP       - INPLANE HINGE STA      =               1
 17 CIPP      - IP MODAL DAMPING       =   2.50000E-01
 18 IBIP      - IP BC 1 OR 2           =               2
 19 NI        - NO. OF IMPLICIT DOFS=                  0
 20 KIP       - IP SPRING RATE         =   5.58000E+08
 21 CIP       - IP DAMPING RATE        =   0.00000E+00
 22 OM        - RPM                    =   3.00000E+02
 23 IC        - ROTATION DIRECTION     =               1
 24 PSI0      - AZIMUTH OF REF BLADE=      0.00000E+00
 25 MHUB      - HUB WEIGHT (LB)        =   0.00000E+00
                                                                 MORE...
```

```
26 IHUBX     - HUB M.O.I. ABOUT X- =  0.00000E+00
27 THO       - ROOT PTCH ANG (DEG) =  0.00000E+00
28 NONLIN    - NONLIN TERMS        =        NO
29 IU        - UNIFORM BLADE       =        NO
30 M         - (REAL) MASS PER UNIT LENGTH
             7.50000E-01  7.50000E-01  6.75000E-01  7.50000E-01
             7.50000E-01  7.50000E-01  7.50000E-01  7.50000E-01
             7.50000E-01  7.50000E-01  7.50000E-01  7.50000E-01
             7.50000E-01
31 SE        - (REAL) CG OFFSET FROM EA
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00
32 SEA       - (REAL) AREA CENTROID OFFSET
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00
33 KM1       - (REAL) MASS ROG ABOUT
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                          MORE...
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00
34 KM2       - (REAL) MASS ROG ABOUT
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00
35 KA        - (REAL) AREA ROG OF CROSS
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00
36 THP       - (REAL) PRETWIST RATE DEG/IN
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00
37 EIY       - (REAL) CHORDWISE EI*10E-6
             5.55800E+02  5.55800E+02  5.00000E+02  5.55800E+02
             5.55800E+02  5.55800E+02  5.55800E+02  5.55800E+02
             5.55800E+02  5.55800E+02  5.55800E+02  5.55800E+02
             5.55800E+02
                                                          MORE...
```

```
 38 EIZ        - (REAL) BEAMWISE EI*10E-6
               1.65000E+02  1.65000E+02  1.65000E+02  1.65000E+02
               1.65000E+02  1.65000E+02  1.65000E+02  1.65000E+02
               1.65000E+02  1.65000E+02  1.65000E+02  1.65000E+02
               1.65000E+02
 39 EA         - (REAL) SECTION EA*10E-6
               2.00000E+01  2.00000E+01  2.00000E+01  2.00000E+01
               2.00000E+01  2.00000E+01  2.00000E+01  2.00000E+01
               2.00000E+01  2.00000E+01  2.00000E+01  2.00000E+01
               2.00000E+01
 40 JIL        - INTERNAL LOADS       =        NO
*********************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
GRRD
DATA MEMBER
CRD3
GRRD     /CRD3      ON FILE U1

***************        GRRD     /CRD3        ***************

GROUND RESONANCE ROTOR DAMAGE

*********************************************************************
INPUT FOR DAMAGED ROTOR  COMPONENT CRD3. ROTOR DAMAGED BLADES

  1 JV         - INPLANE DOF          =          YES
  2 JW         - OUTPLANE DOF         =          NO
  3 JP         - TORSION DOF          =          NO
  4 NV         - NO. OF INPLANE MODES=              1
  5 NDB        - NO. OF DAMAGED       =              4
  6 IDB        - BLADE NOS. OF
                       1         2         3         4
                                                            MORE...
  7 NX         - NO. OF BLADE STAS    =             13
  8 JXD        - NEW STATIONS         =          NO
  9 ITYP       - MODE INPUT 0,1, OR 2=              2
 10 CIPP       - IP MODAL DAMPING     =   0.00000E+00
 11 IBIP       - IP BC 1 OR 2         =              2
 12 KIP        - IP SPRING RATE       =   0.00000E+00
 13 CIP        - IP DAMPING RATE      =   0.00000E+00
 14 IU         - UNIFORM BLADE        =          NO
 15 M          - (REAL) MASS PER UNIT LENGTH
               0.00000E+00  0.00000E+00 -7.50000E-02  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00
 16 SE         - (REAL) CG OFFSET FROM EA
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00
 17 SEA        - (REAL) AREA CENTROID OFFSET
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                            MORE...
```

```
             0.00000E+00
18 KM1       - (REAL) MASS ROG ABOUT
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00
19 KM2       - (REAL) MASS ROG ABOUT
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00
20 KA        - (REAL) AREA ROG OF CROSS
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00  6.00000E+00  6.00000E+00  6.00000E+00
             6.00000E+00
21 THP       - (REAL) PRETWIST RATE DEG/IN
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00
22 EIY       - (REAL) CHORDWISE EI*10E-6
                                                            MORE...
             0.00000E+00  0.00000E+00 -5.58000E+01  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00
23 EIZ       - (REAL) BEAMWISE EI*10E-6
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00
24 EA        - (REAL) SECTION EA*10E-6
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
             0.00000E+00
25 JIL       - INTERNAL LOADS      =         NO
*******************************************************************


LIST COMPLETE
COMMAND
```

```
***************** SOLUTION SSF3 FOR MODEL ACAFD   *****************
MODEL      - DAMAGED ACAF GROUND RESONANCE MODEL
SOLUTION - STABILITY FLOQUET

*******************************************************************

    THIS MODEL WAS EDITED AT RUN TIME   (238 RPM)

*******************************************************************


              FREQUENCY                DAMPING

              34.39589                -1.25660
             -34.39659                -1.25718
              13.66451                -1.01190
             -13.66450                -1.01188
               2.40310                -0.05590
                                                          MORE...
              -2.40311                -0.05591
             115.55717               -41.09233
            -115.55722               -41.09227
              33.37157                -1.07540
             -33.37157                -1.07546
              34.01982                -1.06511
             -34.01981                -1.06510
              34.02486                -1.06820
             -34.02480                -1.06817
*******************************************************************
COMMAND
```

```
***************** SOLUTION SSF3 FOR MODEL ACAPDD  *****************
MODEL      - DAMAGED ACAP GROUND RESONANCE MODEL (CRD3)
SOLUTION - STABILITY FLOQUET

*************************************************************************

     THIS MODEL WAS EDITED AT RUN TIME  (238 RPM)

*************************************************************************

                    FREQUENCY              DAMPING

                    34.40465              -1.25222
                   -34.40436              -1.25200
                    13.62780              -1.02289
                   -13.62781              -1.02294
                     2.41658              -0.05745
                                                              MORE...
                    -2.41658              -0.05746
                   115.60188             -41.11543
                  -115.60191             -41.11540
                    33.37268              -1.07387
                   -33.37274              -1.07392
                    34.02176              -1.06673
                   -34.02173              -1.06673
                    34.02176              -1.06763
                   -34.02167              -1.06751
*************************************************************************
COMMAND
```

2.6.3 Time History Pitch Link Loads - Blade Damage. The helicopter model in Section 6 of the User's Manual (AH1G-35A/MODEL) was used to demonstrate a time history of the pitch link (control rod) loads for the reference blade in an undamaged and damaged condition. The initial conditions and control settings were obtained from the baseline trim solution. Data sets FCT1.65/FRA3 and AH1G16.5/FFC2 were edited to include the trimmed vehicle velocity (wind vector), and FCT1.65/FRA3 was further edited to include the trimmed induced velocity. The acceleration due to gravity was applied using the global reference system with the trimmed fuselage pitch accounted for.

The damage modeled was a 50 percent loss in in-plane and out-of-plane bending stiffness and a 30 percent loss in torsional stiffness over a 1 foot section of the reference blade starting 27 inches outboard of the pitch horn (Figures 17, 18, and 19). For the damaged blade, new blade stations were added for precise definition of the blade properties. The reduced stiffness results in increased curvature in the damaged blade modes. Time histories of the interface loads acting on the individual control rod coupled to the reference blade were generated for the nominal and damaged blade models (Figure 20).

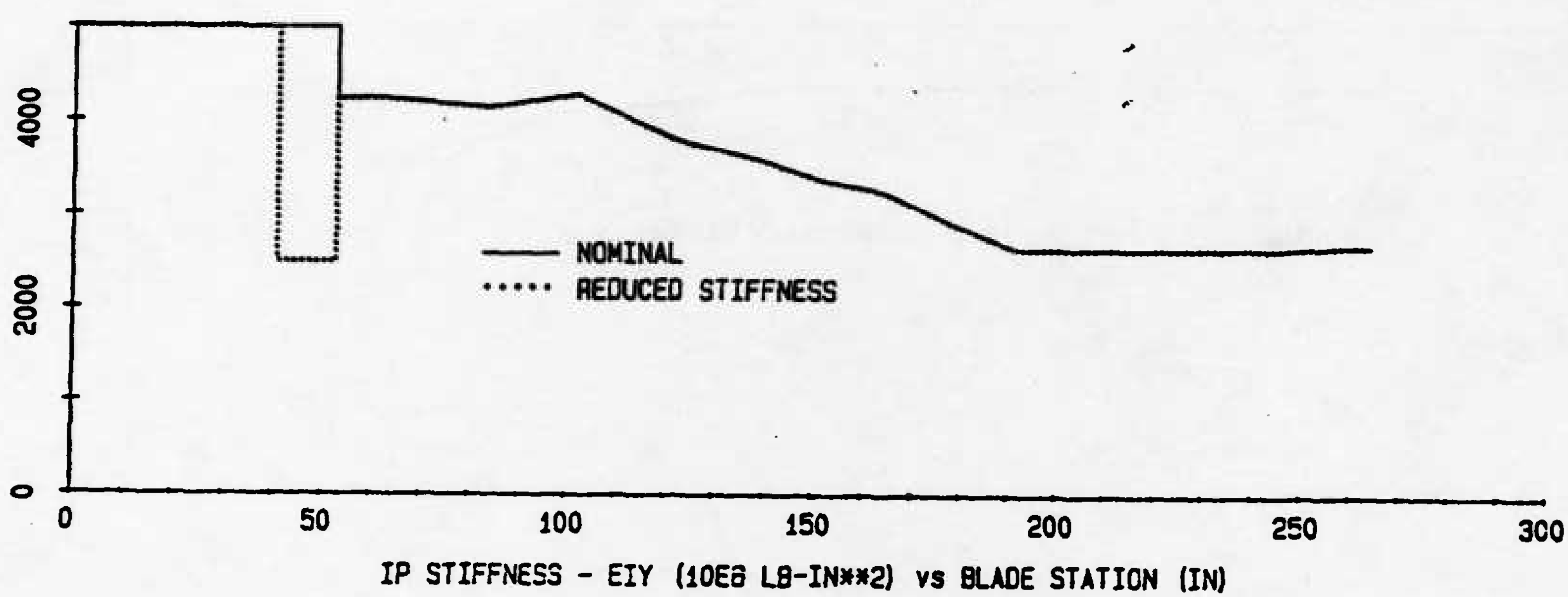

Figure 17. In-Plane Blade Stiffnesses.

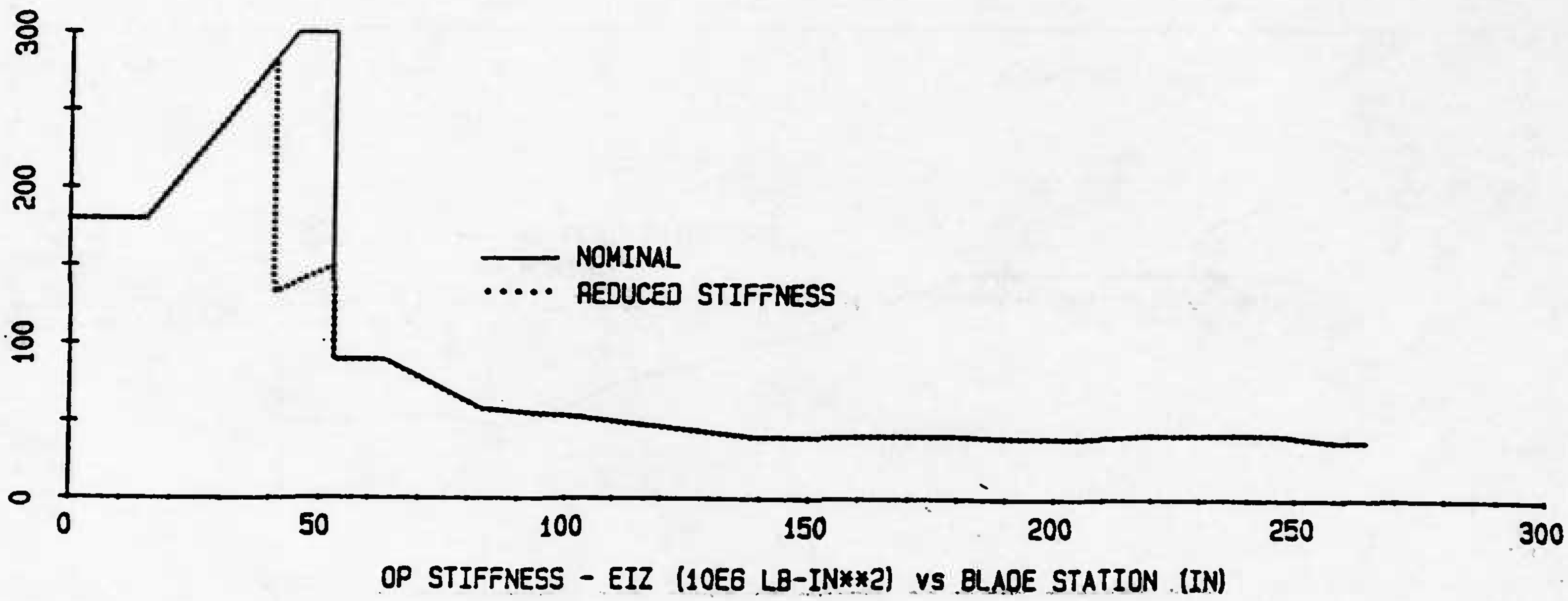

Figure 18. Out-of-Plane Blade Stiffnesses.

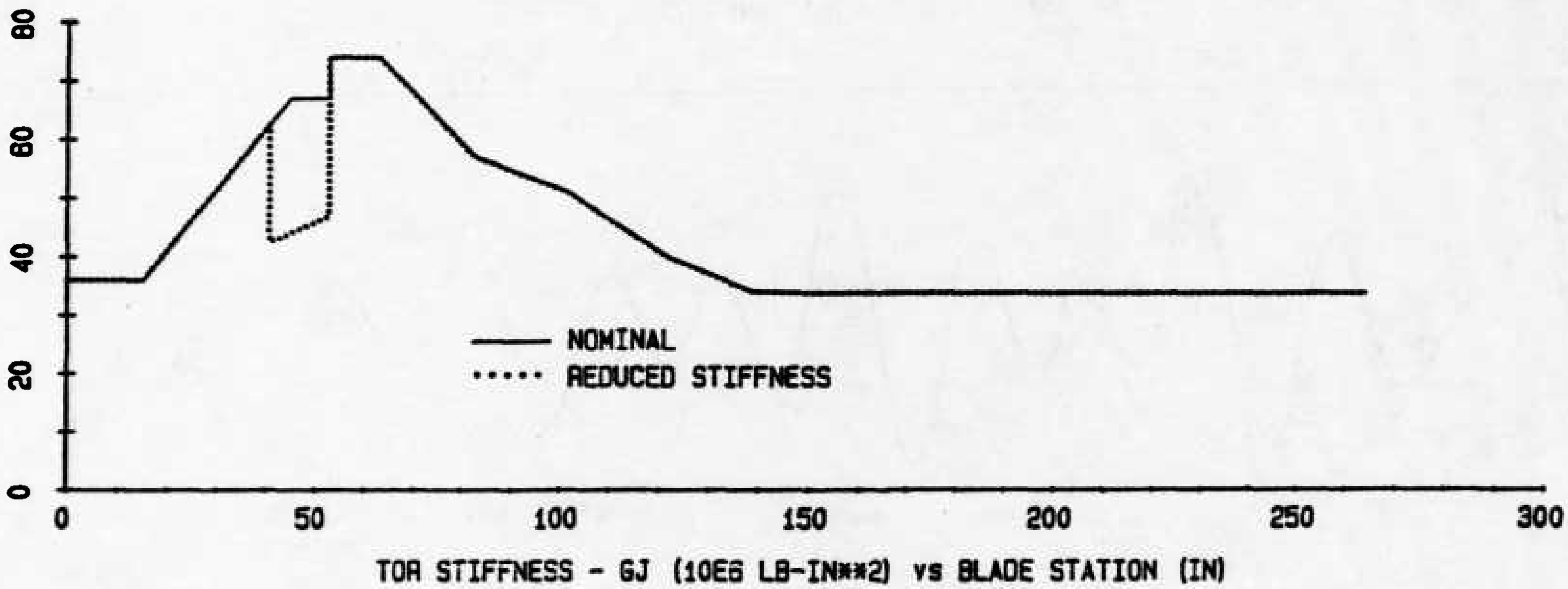

Figure 19. Torsion Blade Stiffnesses.

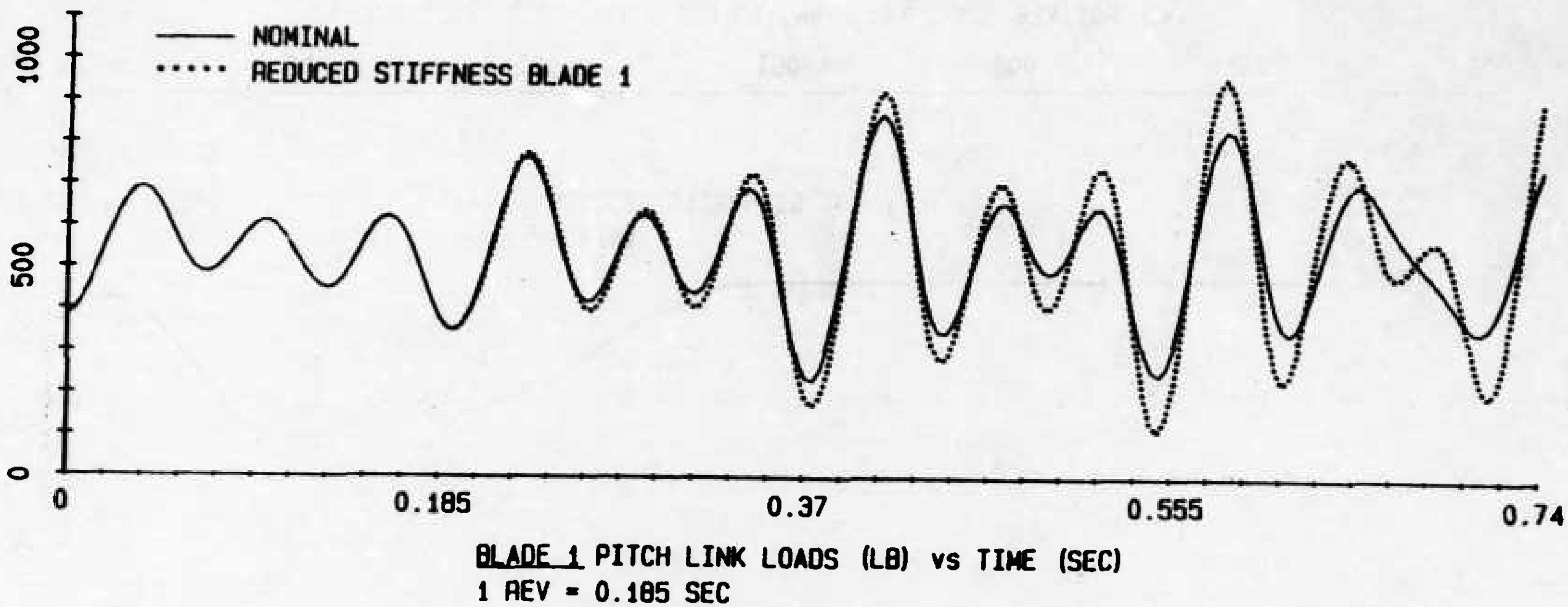

Figure 20. Time History Pitch Link Loads.

```
LIST
DATA SET
TGC
DATA MEMBER
CGL0
TGC      /CGL0      ON FILE U1

***************       TGC      /CGL0      ***************

TRANFORM GLOBAL ACCELERATIONS TO COMPONENT COORDS

**********************************************************************
INPUT FOR COMPONENT CGL0. GLOBAL REFERENCE

   1 NCGL      - NO. OF COMPONENTS    =              2
   2 IGSEQ     - SEQUENCE NUMBERS     =              1              4
   3 XYDG      - (REAL) COMPONENT X.Y VECTOR
           GENERAL MATRIX

    ROW     1
          1.00000E+00  1.00000E+00
                                                                 MORE...
    ROW     2      NULL ROW
    ROW     3      NULL ROW
    ROW     4      NULL ROW
    ROW     5
          1.00000E+00  1.00000E+00
    ROW     6      NULL ROW
   4 CDFLI     - DOF NAME             =       X      0
**********************************************************************


LIST COMPLETE.
COMMAND
```

```
LIST
DATA SET
DEL
DATA MEMBER
CLC0
DEL       /CLC0       ON FILE U1


***************        DEL      /CLC0       ***************

DELETE ARTIFICIAL CGL0 DOF

********************************************************************
INPUT FOR COMPONENT CLC0. ELIMINATE DOF

  1 NCIDF     - # OF ELIMINATED DOF =             1
  2 CIDFLI    - ELIMINATED DOF NAMES=      X      0
  3 CDFLI     - 1 EXPLICIT DOF NAME =      XCG 1000
********************************************************************


                                                             MORE...
LIST COMPLETE
COMMAND
```

```
RUN
MODEL NAME (DATA SET)
AH1GR
LIST MODEL SUMMARY (Y OR N)
Y

************************        MODEL AH1GR        **********************

AH1 WITH GRAVITY FORCE APPLIED THROUGH GLOBAL REF SYS

INDEX    COMP     NO.    DATA SET           FORCE    DATA SET
  1      CRE3      1     B2Z1T2             FRA3     FCT1.65
                                       REQUIRED DS/DM= AFD161   /AIRFOIL
  2      CCE0      1     3000               NONE
  3      CLC1            COUPLE             NONE
  4      CFM2      1     8300-4             FFC2     AH1G16.5
  5      CGL0            TGC                NONE
  6      CLC0            DEL                NONE

*********************************************************************
                                                              MORE...

*********************************************************************
                         GLOBAL  VARIABLES

  1 VSOUND    - SOUND VELOCITY        =  1.13800E+03
  2 RHO       - AIR DENSITY RATIO     =  8.79000E-01
*********************************************************************


                                                              RUNNING
```

```
*****************************************************************************
SOLUTION INPUT FOR STH3.TIME HISTORY

  1 TSTA       - START TIME             =  0.00000E+00
  2 H          - INITIAL INCREMENT      =  3.70370E-03
  3 HTD        - SEPARATE INCREMENT     =  0.00000E+00
  4 HF         - SEPARATE INCREMENT     =  0.00000E+00
  5 TEND       - END TIME               =  7.40740E-01
  6 E          - ERROR CHECK VALUE      =  0.00000E+00
  7 ICOPT      - INITIAL CONDITION      =            2
  8 YV         - (REAL) INITIAL VELOCITY
              -1.77456E+00 -1.55660E-02  1.68748E+00 -7.87600E-03
               2.81340E-01 -2.29978E-01  2.91548E-01  3.36010E-02
              -8.98260E-02  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00
  9 YD         - (REAL) INITIAL DISPLACEMENT
               9.88300E-03  5.19700E-03 -6.94290E-02 -3.51700E-03
               1.83410E-02  2.80760E-02  2.39880E-02 -4.44800E-03
              -3.36500E-03  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00
 10 ICON       - ROTOR CONTROLS         =            1
                                                                    MORE...
 11 MROT       - NUMBER OF ROTORS       =            1
 12 IR1        - ROTOR NUMBER           =            1
 13 A01        - COLLECTIVE ANGLE       = -1.56300E-02
 14 A1C1       - COSINE ANGLE (RAD)     =  7.91000E-03
 15 A1S1       - SINE ANGLE (RAD)       = -6.25800E-02
 16 NH1        - HIGHER HARMONIC        =            0
 17 ITOUT      - ROTOR FORCE OUTPUT     =            0
 18 CRT        - OUTPUT THIS TERMINAL=            YES
 19 ITEET      - TEETERING ROTOR        =          YES
 20 LINK       - (REAL) HORIZONTAL TAIL LINK
               1.00000E-01 -1.24000E-01  3.52000E+00
 21 ILOP       - SAVE STATE VECTORS     =          YES
 22 JIIL       - INPUT I. EVERY ITH     =            1
 23 GS         - VERT ACCELERATION      =  1.00000E+00
 24 ICF        - CONSIDER CENTRIFUGAL=             NO
 25 XYDI       - (REAL) GLOBAL X.Y VECTOR
               9.99880E-01  0.00000E+00  1.52100E-02  0.00000E+00
               1.00000E+00  0.00000E+00
*****************************************************************************

RE-ENTER (Y OR N)
```

```
**************************************************************************
SOLUTION INPUT FOR SII3.TIME HISTORY LOADS

  1 IFL       - INTERFACE LOADS       =          YES
  2 IFLDF     - (COMPONENT DOFS SELECTED) INTERFACE DOF
    COMPONENT 3000      /CCE0 DOFS
          RODR1100  RODR1200
  3 IFLPL     - PLOT INTERFACE LOADS=            YES
  4 INL       - INTERNAL LOADS        =          NO
**************************************************************************

RE-ENTER (Y OR N)
```

```
DATA SET
BTLOSS
DATA MEMBER
CRD3
BTLOSS  /CRD3     ON FILE U1

***************      BTLOSS  /CRD3      ***************

50 PCT LOSS (EIY.EIZ) 30 PCT LOSS (GJ) BS 40.79 - 52.79

*********************************************************************
INPUT FOR DAMAGED ROTOR  COMPONENT CRD3. ROTOR DAMAGED BLADES

  1 JV         - INPLANE DOF          =          YES
  2 JW         - OUTPLANE DOF         =          YES
  3 JP         - TORSION DOF          =          YES
  4 NV         - NO. OF INPLANE MODES=             1
  5 NW         - NO. OF OUTPLNE MODES=             2
  6 NP         - NO. OF TORSION MODES=             2
  7 NDB        - NO. OF DAMAGED       =            1
                                                          MORE...
  8 IDB        - BLADE NOS. OF        =            1
  9 NX         - NO. OF BLADE STAS    =           21
 10 JXD        - NEW STATIONS         =          YES
 11 X          - (REAL) STATIONS
                 0.00000E+00  1.50000E+01  4.07800E+01  4.07900E+01
                 5.27900E+01  5.28000E+01  6.29000E+01  8.27000E+01
                 1.01700E+02  1.21500E+02  1.38600E+02  1.50500E+02
                 1.63700E+02  1.78200E+02  1.91400E+02  2.05150E+02
                 2.18350E+02  2.31250E+02  2.45500E+02  2.57400E+02
                 2.64000E+02
 12 ITYP       - MODE INPUT 0.1. OR 2=             1
 13 VPPD       - (REAL) 2ND DERIVATIVE OF IP
              GENERAL MATRIX

    ROW    1
           3.64850E-05
    ROW    2
           9.24470E-05
    ROW    3
           1.53210E-05
    ROW    4
           2.29820E-05
                                                          MORE...
```

```
ROW     5
        2.16190E-05
ROW     6
        1.44120E-05
ROW     7
        2.58380E-05
ROW     8
        2.22030E-05
ROW     9
        1.79180E-05
ROW     10
        1.61000E-05
ROW     11
        1.37630E-05
ROW     12
        1.23350E-05
ROW     13
        1.02570E-05
ROW     14
        8.69940E-06
ROW     15
        7.01150E-06
                                                      MORE...
ROW     16
        4.67430E-06
ROW     17
        2.85650E-06
ROW     18
        1.55810E-06
ROW     19
        5.19360E-07
ROW     20       NULL ROW
ROW     21       NULL ROW
14 VPD          - (REAL) 1ST DERIVATIVE OF IP
          GENERAL MATRIX

ROW     1        NULL ROW
ROW     2
        9.67000E-04
ROW     3
        2.58350E-03
ROW     4
        2.58350E-03
ROW     5
        2.79090E-03
                                                      MORE...
```

```
ROW      6
         2.79110E-03
ROW      7
         2.99430E-03
ROW      8
         3.46990E-03
ROW      9
         3.85110E-03
ROW     10
         4.18790E-03
ROW     11
         4.44320E-03
ROW     12
         4.59850E-03
ROW     13
         4.74760E-03
ROW     14
         4.88500E-03
ROW     15
         5.08810E-03
ROW     16
         5.06910E-03
                                                    MORE...
ROW     17
         5.11880E-03
ROW     18
         5.14720E-03
ROW     19
         5.16210E-03
ROW     20
         5.16510E-03
ROW     21
         5.46660E-03
15 VD          - (REAL) INPLANE MODE SHAPES
          GENERAL MATRIX

ROW      1      NULL ROW
ROW      2
         7.25200E-03
ROW      3
         6.05100E-02
ROW      4
         6.05100E-02
ROW      5
         8.10800E-02
                                                    MORE...
```

```
          8.11100E-02
ROW        7
          1.09400E-01
ROW        8
          1.71590E-01
ROW        9
          2.39400E-01
ROW       10
          3.17100E-01
ROW       11
          3.89400E-01
ROW       12
          4.42100E-01
ROW       13
          5.02500E-01
ROW       14
          5.71100E-01
ROW       15
          6.35000E-01
ROW       16
          7.03000E-01
                                                      MORE...
ROW       17
          7.68900E-01
ROW       18
          8.34000E-01
ROW       19
          9.06100E-01
ROW       20
          9.66500E-01
ROW       21
          1.00000E+00
16 WPPD       - (REAL) 2ND DERIVATIVE OF OP
           GENERAL MATRIX

ROW        1
          0.00000E+00  3.91000E-05
ROW        2
          0.00000E+00  5.00700E-05
ROW        3
          0.00000E+00  1.46800E-05
ROW        4
          0.00000E+00  2.20200E-05
ROW        5
                                                      MORE...
```

```
         0.00000E+00  1.89800E-05
    ROW   6
         0.00000E+00  1.26500E-05
    ROW   7
         0.00000E+00  4.67600E-05
    ROW   8
         0.00000E+00  4.91800E-05
    ROW   9
         0.00000E+00  3.31100E-05
    ROW  10
         0.00000E+00  2.47100E-05
    ROW  11
         0.00000E+00  1.81400E-05
    ROW  12
         0.00000E+00  1.36900E-05
    ROW  13
         0.00000E+00  9.83600E-06
    ROW  14
         0.00000E+00  6.92000E-06
    ROW  15
         0.00000E+00  5.19000E-06
    ROW  16
                                                    MORE...
         0.00000E+00  3.60800E-06
    ROW  17
         0.00000E+00  2.22400E-06
    ROW  18
         0.00000E+00  1.28500E-06
    ROW  19
         0.00000E+00  4.94300E-07
    ROW  20
         0.00000E+00  9.88600E-08
    ROW  21      NULL ROW
 17 WPD        - (REAL) 1ST DERIVATIVE OF OP
          GENERAL MATRIX

    ROW   1
         3.78780E-03  0.00000E+00
    ROW   2
         3.78780E-03  6.68800E-04
    ROW   3
         3.78780E-03  1.64000E-03
    ROW   4
         3.78780E-03  1.64000E-03
    ROW   5
                                                    MORE...
```

```
         3.78780E-03   1.83400E-03
ROW      6
         3.78780E-03   1.83400E-03
ROW      7
         3.78780E-03   2.13400E-03
ROW      8
         3.78780E-03   3.08400E-03
ROW      9
         3.78780E-03   3.86600E-03
ROW      10
         3.78780E-03   4.43900E-03
ROW      11
         3.78780E-03   4.80500E-03
ROW      12
         3.78780E-03   4.99500E-03
ROW      13
         3.78780E-03   5.15000E-03
ROW      14
         3.78780E-03   5.27100E-03
ROW      15
         3.78780E-03   5.35100E-03
ROW      16
                                                        MORE...
         3.78780E-03   5.41200E-03
ROW      17
         3.78780E-03   5.45000E-03
ROW      18
         3.78780E-03   5.47300E-03
ROW      19
         3.78780E-03   5.48600E-03
ROW      20
         3.78780E-03   5.48900E-03
ROW      21
         3.78780E-03   5.48900E-03
18 WD         - (REAL) OUTPLANE MODE SHAPES
          GENERAL MATRIX

ROW      1      NULL ROW
ROW      2
         5.68100E-02   5.01600E-03
ROW      3
         1.70450E-01   3.96500E-02
ROW      4
         1.70450E-01   3.96500E-02
ROW      5
                                                        MORE...
```

```
ROW     6
        2.00100E-01  5.28500E-02
ROW     7
        2.38200E-01  7.20000E-02
ROW     8
        3.13250E-01  1.21900E-01
ROW     9
        3.85200E-01  1.86300E-01
ROW     10
        4.60200E-01  2.66800E-01
ROW     11
        5.25000E-01  3.44300E-01
ROW     12
        5.70000E-01  4.01600E-01
ROW     13
        6.20000E-01  4.67300E-01
ROW     14
        6.75000E-01  5.41600E-01
ROW     15
        7.25000E-01  6.10600E-01
ROW     16
                                                      MORE...
        7.77000E-01  6.83400E-01
ROW     17
        8.27100E-01  7.54000E-01
ROW     18
        8.75900E-01  8.23200E-01
ROW     19
        9.30000E-01  9.00000E-01
ROW     20
        9.75000E-01  9.64000E-01
ROW     21
        1.00000E+00  1.00000E+00
19 PHPPD     - (REAL) 2ND DERIVATIVE OF TO
          NULL MATRIX

20 PHPD      - (REAL) 1ST DERIVATIVE OF TO
          GENERAL MATRIX

ROW     1
        0.00000E+00  3.74000E-03
ROW     2
        0.00000E+00  3.74000E-03
ROW     3
                                                      MORE...
```

```
              0.00000E+00   3.74000E-03
      ROW      4
              0.00000E+00   4.86000E-03
      ROW      5
              0.00000E+00   4.86000E-03
      ROW      6
              0.00000E+00   3.74000E-03
      ROW      7
              0.00000E+00   3.74000E-03
      ROW      8
              0.00000E+00   3.74000E-03
      ROW      9
              0.00000E+00   3.74000E-03
      ROW     10
              0.00000E+00   3.74000E-03
      ROW     11
              0.00000E+00   3.74000E-03
      ROW     12
              0.00000E+00   3.74000E-03
      ROW     13
              0.00000E+00   3.74000E-03
      ROW     14
                                                          MORE...
              0.00000E+00   3.74000E-03
      ROW     15
              0.00000E+00   3.74000E-03
      ROW     16
              0.00000E+00   3.74000E-03
      ROW     17
              0.00000E+00   3.74000E-03
      ROW     18
              0.00000E+00   3.74000E-03
      ROW     19
              0.00000E+00   3.74000E-03
      ROW     20
              0.00000E+00   3.74000E-03
      ROW     21
              0.00000E+00   3.74000E-03
   21 PHD         - (REAL) TORSION MODE SHAPES
               GENERAL MATRIX

      ROW      1
              1.00000E+00   0.00000E+00
      ROW      2
              1.00000E+00   5.60000E-02
                                                          MORE...
```

```
ROW     3
        1.00000E+00  1.68200E-01
ROW     4
        1.00000E+00  1.68200E-01
ROW     5
        1.00000E+00  2.10700E-01
ROW     6
        1.00000E+00  2.10800E-01
ROW     7
        1.00000E+00  2.48500E-01
ROW     8
        1.00000E+00  3.22500E-01
ROW     9
        1.00000E+00  3.93400E-01
ROW    10
        1.00000E+00  4.67400E-01
ROW    11
        1.00000E+00  5.31400E-01
ROW    12
        1.00000E+00  5.75700E-01
ROW    13
        1.00000E+00  6.25100E-01
                                                           MORE...
ROW    14
        1.00000E+00  6.79300E-01
ROW    15
        1.00000E+00  7.28700E-01
ROW    16
        1.00000E+00  7.80000E-01
ROW    17
        1.00000E+00  8.29300E-01
ROW    18
        1.00000E+00  8.77600E-01
ROW    19
        1.00000E+00  9.30900E-01
ROW    20
        1.00000E+00  9.75300E-01
ROW    21
        1.00000E+00  1.00000E+00
22 CIPP      - IP MODAL DAMPING     =  0.00000E+00
23 COPP      - OP MODAL DAMPING     =  0.00000E+00  0.00000E+00
24 CTORR     - TORSION MODAL        =  0.00000E+00  0.00000E+00
25 KIP       - IP SPRING RATE       =  0.00000E+00
26 CIP       - IP DAMPING RATE      =  0.00000E+00
27 KOP       - OP SPRING RATE       =  0.00000E+00
                                                           MORE...
```

```
28 COP        - OP DAMPING RATE     =  0.00000E+00
29 KTOR       - TORSION SPRING RATE =  0.00000E+00
30 CTOR       - TORSION DAMPING RATE=  0.00000E+00
31 IU         - UNIFORM BLADE       =           NO
32 M          - (REAL) MASS PER UNIT LENGTH
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00
33 SE         - (REAL) CG OFFSET FROM EA
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00
34 SEA        - (REAL) AREA CENTROID OFFSET
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                              MORE...
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00
35 KM1        - (REAL) MASS ROG ABOUT
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00
36 KM2        - (REAL) MASS ROG ABOUT
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00
37 KA         - (REAL) AREA ROG OF CROSS
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                              MORE...
```

```
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00
38 THP     - (REAL) PRETWIST RATE DEG/IN
          -3.78753E-02 -3.78753E-02 -3.78753E-02 -3.78753E-02
          -3.78753E-02 -3.78753E-02 -3.78753E-02 -3.78753E-02
          -3.78753E-02 -3.78753E-02 -3.78753E-02 -3.78753E-02
          -3.78753E-02 -3.78753E-02 -3.78753E-02 -3.78753E-02
          -3.78753E-02 -3.78753E-02 -3.78753E-02 -3.78753E-02
          -3.78753E-02
39 EIY     - (REAL) CHORDWISE EI*10E-6
           0.00000E+00  0.00000E+00  0.00000E+00 -2.50000E+03
          -2.50000E+03  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00
40 EIZ     - (REAL) BEAMWISE EI*10E-6
           0.00000E+00  0.00000E+00  0.00000E+00 -1.50000E+02
          -1.50000E+02  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
                                                              MORE...
           0.00000E+00
41 EA      - (REAL) SECTION EA*10E-6
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00
42 GJ      - (REAL) SECTION GJ*10E-6
           0.00000E+00  0.00000E+00  0.00000E+00 -2.01000E+01
          -2.01000E+01  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00
43 EB1     - (REAL) CROSS SEC INTEGRAL
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
           0.00000E+00
                                                              MORE...
```

```
44 EB2       - (REAL) CROSS SEC INTEGRAL
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00
45 EC1       - (REAL) CROSS SEC INTEGRAL
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00
46 EC1STA    - (REAL) CROSS SEC INTEGRAL
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
               0.00000E+00
47 JIL       - INTERNAL LOADS      =        NO
                                                              MORE...
**********************************************************************


LIST COMPLETE
COMMAND
```

```
LIST
DATA SET
DTGC
DATA MEMBER
CGL0
DTGC    /CGL0      ON FILE U1

***************       DTGC    /CGL0      ***************

TRANFORM GLOBAL ACCELERATIONS TO COMPONENT COORDS

*****************************************************************
INPUT FOR COMPONENT CGL0. GLOBAL REFERENCE

  1 NCGL      - NO. OF COMPONENTS   =              3
  2 IGSEQ     - SEQUENCE NUMBERS
                     1          2         5
  3 XYDG      - (REAL) COMPONENT X.Y VECTOR
           GENERAL MATRIX

    ROW    1
                                                        MORE...
          1.00000E+00  1.00000E+00  1.00000E+00
    ROW    2      NULL ROW
    ROW    3      NULL ROW
    ROW    4      NULL ROW
    ROW    5
          1.00000E+00  1.00000E+00  1.00000E+00
    ROW    6      NULL ROW
  4 CDFLI     - DOF NAME            =      X      0
*****************************************************************


LIST COMPLETE
COMMAND
```

```
RUN
MODEL NAME (DATA SET)
DAH1GR
LIST MODEL SUMMARY (Y OR N)
Y

***********************       MODEL DAH1GR      **********************

AH1GR WITH BLADE DAMAGE

INDEX    COMP     NO.    DATA SET            FORCE    DATA SET

  1      CRE3      1     B2Z1T2              FRA3     FCT1.65
                                       REQUIRED DS/DM= AFD161   /AIRFOIL
  2      CRD3      1     BTLOSS              FRA3     FCT1.65
                                       REQUIRED DS/DM= AFD161   /AIRFOIL
  3      CCE0      1     3000                NONE
  4      CLC1            COUPLE              NONE
  5      CFM2      1     8300-4              FFC2     AH1G16.5
  6      CGL0            DTGC                NONE
  7      CLC0            DEL                 NONE
                                                              MORE...

*********************************************************************

*********************************************************************
                         GLOBAL  VARIABLES

  1 VSOUND    - SOUND VELOCITY       =  1.13800E+03
  2 RHO       - AIR DENSITY RATIO    =  8.79000E-01
*********************************************************************


MULTIPLE REFERENCE TO AFD161  /AIRFOIL
THE SAME UNIT HAS BEEN ASSIGNED
                                                              RUNNING
```

```
*************************************************************************
SOLUTION INPUT FOR STH3.TIME HISTORY

   1 TSTA      - START TIME            =  1.85185E-01
   2 H         - INITIAL INCREMENT     =  3.70370E-03
   3 HTD       - SEPARATE INCREMENT    =  0.00000E+00
   4 HF        - SEPARATE INCREMENT    =  0.00000E+00
   5 TEND      - END TIME              =  7.40740E-01
   6 E         - ERROR CHECK VALUE     =  0.00000E+00
   7 ICOPT     - INITIAL CONDITION     =            3
   8 ICON      - ROTOR CONTROLS        =            2
   9 ITOUT     - ROTOR FORCE OUTPUT    =            0
  10 CRT       - OUTPUT THIS TERMINAL=            YES
  11 ITEET     - TEETERING ROTOR       =          YES
  12 LINK      - (REAL) HORIZONTAL TAIL LINK
               1.00000E-01 -1.24000E-01  3.52000E+00
  13 ILOP      - SAVE STATE VECTORS    =          YES
  14 JIIL      - INPUT I. EVERY ITH    =            1
  15 GS        - VERT ACCELERATION     =  1.00000E+00
  16 ICF       - CONSIDER CENTRIFUGAL=             NO
  17 XYDI      - (REAL) GLOBAL X.Y VECTOR
                                                             MORE...
               9.99880E-01  0.00000E+00  1.52100E-02  0.00000E+00
               1.00000E+00  0.00000E+00
*************************************************************************

RE-ENTER (Y OR N)
```

```
*******************************************************************
SOLUTION INPUT FOR SII3.TIME HISTORY LOADS

  1 IFL        - INTERFACE LOADS      =          YES
  2 IFLDF      - (COMPONENT DOFS SELECTED) INTERFACE DOF
   COMPONENT 3000     /CCE0 DOFS
         RODR1100  RODR1200
  3 IFLPL      - PLOT INTERFACE LOADS=           YES
  4 INL        - INTERNAL LOADS       =          NO
*******************************************************************

RE-ENTER (Y OR N)
```

2.6.4 Trim - Global Reference System. The trim solution of the model in Section 6 of the User's Manual (AH2G-35A/MODEL) was repeated to validate the global reference system. The baseline model was then modified in order to trim for a 10 degree, steady left banked turn at 60 knots with force balancing for the XCG, YCG, ZCG, ALFX, ALFY (no ALFZ) degrees of freedom. To minimize the size of the model and reduce solution time, the torsion and out-of-plane elastic degrees of freedom of the blades were deleted; the effect of the elastic modes on trim is small by comparison to the rigid body modes.

Using the information above and the simple relationships for a steady coordinated turn, the turn rate, Ω, and the turn radius, R, were calculated:

$$R = V^2/(g \tan \phi)$$

$$\Omega = V/R$$

where V is forward velocity, g is acceleration due to gravity, and ϕ is bank angle. The initial velocities, displacements, and control settings were obtained from the baseline trim solution, and the trim (control) parameters were chosen to be A0, A1S, A1C, APTCH, and AYAW with AROLL (bank angle) held constant.

```
EXECUTION BEGINS...
USER FILE U1 TO BE INITIALIZED (Y OR N)
COMMAND
MODEL NAME (DATA SET)
LIST MODEL SUMMARY (Y OR N)

************************          MODEL AH1T          **********************

AH1 TRIM. GRAVITY FORCE APPLIED THROUGH GLOBAL REF SYS

INDEX    COMP    NO.    DATA SET         FORCE    DATA SET

  1      CRE3     1     B2Z1T2           FRA3     FCT1.65
                                    REQUIRED DS/DM= AFD161   /AIRFOIL
  2      CCE0     1     3000             NONE
  3      CLC1           COUPLE           NONE
  4      CFM2     1     8300-4           FFC2     AH1G16.5
  5      CGL0           TGC              NONE
  6      CLC0           DEL              NONE
                                                                 MORE...

*********************************************************************

*********************************************************************
                              GLOBAL  VARIABLES

  1 VSOUND   - SOUND VELOCITY       =  1.13800E+03
  2 RHO      - AIR DENSITY RATIO    =  8.79000E-01
*********************************************************************
```

```
****************************************************************************
SOLUTION INPUT FOR STR3.TRIM SOLUTION

  1 IFUS      - PERIODIC MOTION      =          NO
  2 ITEET     - TEETERING ROTOR      =         YES
  3 TRCOVA7   - VALUE A              =  1.00000E-01
  4 TRCOVA8   - VALUE B              = -1.24000E-01
  5 TRCOVA9   - VALUE C              =  3.52000E+00
  6 H         - INITIAL INCREMENT    =  3.70370E-03
  7 TPER      - INTEGRATION PERIOD   =  1.85185E-01
  8 HTD       - SEPARATE INCREMENT   =  0.00000E+00
  9 HF        - SEPARATE INCREMENT   =  0.00000E+00
 10 E         - ERROR CHECK VALUE    =  0.00000E+00
 11 ITRIM     - CASE NUMBER          =            1
 12 NALLOW    - NO. OF ITERATIONS    =            8
 13 CEA       - CONSTANT ERROR       =         YES
 14 CEALLO    - CONSTANT ERROR       =  1.00000E-05
 15 EALLOWT1  - (REAL) TRIM ERRORS ALLOWED
             1.00000E-05  1.00000E-05  1.00000E-05  1.00000E-05
 16 CI        - CONSTANT INCREMENT   =         YES
 17 CICRE     - CONSTANT INCREMENT   =  5.00000E-03
 18 DELTAT1   - (REAL) CONTROL VAR INCRMNTS
             5.00000E-03  5.00000E-03  5.00000E-03  5.00000E-03
 19 IWIND     - WIND VELOCITY Y OR N=           NO
 20 VTRANG    - (REAL) FUSELAGE TRANS VEL
            -1.36800E+03  0.00000E+00  0.00000E+00
 21 IROTIN    - FUSELAGE ANGULAR VEL=           NO
 22 CT        - ROTOR THRUST         =  8.00000E+03
 23 IGUESS    - INITIAL GUESSES      =          NO
 24 APTCH     - GUESS FUSELAGE ANGLE= -1.50000E-02
 25 ISTEAD    - STEADY TIME HISTORY =           NO
 26 CRT       - OUTPUT THIS TERMINAL=          YES
 27 GS        - VERT ACCELERATION    =  1.00000E+00

****************************************************************************

RE-ENTER (Y OR N)
```

```
***************** SOLUTION STR3 FOR MODEL AH1T     ****************
MODEL    - AH1 TRIM. GRAVITY FORCE APPLIED THROUGH GLOBAL REF SYS
SOLUTION - TRIM SOLUTION


NO. OF ITERATION =     1

INITIAL CONDITIONS ARE:

                  VELOCITY         DISPLACEMENT

  TOR 1110        0.207232           0.032726

  TOR 1120       -0.633156           0.041145

  TOR 1210       -1.941833          -0.135442

  TOR 1220        4.441874          -0.019792

  TEET   0        0.562461           0.041244

  OPOP1120       -0.890812           0.034387

  OPOP1220       -0.200462           0.025052

  IPIP1110        0.048308          -0.002321

  IPIP1210       -0.074492          -0.005202

A0 =    -0.04959   A1C =    0.01164   A1S =    -0.05127

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

   9.9995E-01   0.0000E+00   9.9998E-03

   0.0000E+00   1.0000E+00   0.0000E+00

  -9.9998E-03   0.0000E+00   9.9995E-01
                                                            MORE...

FUSELAGE PITCH ANGLE =    -0.0171235

AERODYNAMIC FORCES ARE:

        TORQ          XFOR        YFOR        ZFOR          HP
  -144170.75        282.76      198.97    11905.85     -741.15

        MOMX          MOMY
    52449.19     231336.12
```

INDUCED VEL = -0.01200

VEL W.R.T. ROTOR SYSTEM ARE:

-1367.9316	0.0000	13.6798

VEL W.R.T. FUSE SYSTEM ARE:

-1367.9316	0.0000	13.6798

UNBALANCE FORCES ARE:

FX	FZ	MX	MY
428.01	3835.17	52409.59	272898.69

FUSLAGE LIFT.DRAG.MOM.FX.FY.FZ:

-2.48	223.91	-4774.82	223.87	0.00	-4.72

WING LIFT.DRAG.MOM.FX.FY.FZ:

270.91	24.47	-382.35	27.18	0.00	270.65

HTAIL LIFT.DRAG.MOM.FX.FY.FZ:

-35.23	5.16	0.00	4.81	0.00	-35.28

VTAIL LIFT.DRAG.MOM.FX.FY.FZ:

56.39	12.82	0.00	12.82	56.39	0.00

NO. OF ITERATION = 2

INITIAL CONDITIONS ARE:

MORE...

	VELOCITY	DISPLACEMENT
TOR 1110	-2.381526	0.026240
TOR 1120	-1.348439	0.012936
TOR 1210	2.455760	-0.075191
TOR 1220	0.895980	-0.009412
TEET 0	0.482120	0.047529
OPOP1120	-0.227840	0.025087
OPOP1220	0.417426	0.016615
IPIP1110	-0.038940	-0.003402
IPIP1210	-0.121398	-0.002156

```
A0 =    -0.01061   A1C =    -0.02924   A1S =    -0.09173

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

   9.9993E-01   0.0000E+00   1.2123E-02

   0.0000E+00   1.0000E+00   0.0000E+00

  -1.2123E-02   0.0000E+00   9.9993E-01

FUSELAGE PITCH ANGLE =   -0.0085347

AERODYNAMIC FORCES ARE:

        TORQ          XFOR         YFOR         ZFOR          HP
   -55446.84        -46.31      -184.86      4823.69      -285.04

        MOMX          MOMY
   172769.06      59710.14

INDUCED VEL =    -0.02015

VEL W.R.T. ROTOR SYSTEM ARE:
  -1367.8994       0.0000      16.5845

                                                                MORE...
VEL W.R.T. FUSE SYSTEM ARE:
  -1367.8994       0.0000      16.5845

 UNBALANCE FORCES ARE:

        FX            FZ           MX           MY
       81.82      -3244.31    172729.87     63686.53

FUSLAGE LIFT.DRAG.MOM.FX.FY.FZ:
    -3.00      223.88  -4854.40      223.82       0.00      -5.72

WING LIFT.DRAG.MOM.FX.FY.FZ:
   270.83       24.47   -382.35       27.75       0.00     270.52

HTAIL LIFT.DRAG.MOM.FX.FY.FZ:
   -31.34        5.16      0.00        4.78       0.00     -31.40

VTAIL LIFT.DRAG.MOM.FX.FY.FZ:
    56.39       12.82      0.00       12.82      56.39       0.00

                                                                MORE...
```

NO. OF ITERATION = 3

INITIAL CONDITIONS ARE:

	VELOCITY	DISPLACEMENT
TOR 1110	-1.863174	0.008771
TOR 1120	-0.046465	0.005057
TOR 1210	1.754134	-0.069708
TOR 1220	-0.046881	-0.003408
TEET 0	0.277514	0.018023
OPOP1120	-0.213060	0.028282
OPOP1220	0.245676	0.024696
IPIP1110	0.026687	-0.004516

MORE...

IPIP1210	-0.064251	-0.003437

A0 = -0.01590 A1C = 0.00840 A1S = -0.06279

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

9.9999E-01	0.0000E+00	3.5347E-03
0.0000E+00	1.0000E+00	0.0000E+00
-3.5347E-03	0.0000E+00	9.9999E-01

FUSELAGE PITCH ANGLE = -0.0145171

AERODYNAMIC FORCES ARE:

TORQ	XFOR	YFOR	ZFOR	HF
-90180.19	-343.04	-201.32	8081.32	-465.60

MOMX	MOMY
27809.63	29331.90

MORE...

INDUCED VEL = -0.02018

VEL W.R.T. ROTOR SYSTEM ARE:
-1367.9915 0.0000 4.8355

VEL W.R.T. FUSE SYSTEM ARE:
-1367.9915 0.0000 4.8355

UNBALANCE FORCES ARE:

FX	FZ	MX	MY
-145.38	28.40	27770.10	5824.95

FUSLAGE LIFT.DRAG.MOM.FX.FY.FZ:

-0.88	224.03	-4532.84	224.02	0.00	-1.67

WING LIFT.DRAG.MOM.FX.FY.FZ:

270.66	24.47	-382.35	25.43	0.00	270.57

HTAIL LIFT.DRAG.MOM.FX.FY.FZ:

-19.87	5.16	0.00	5.09	0.00	-19.89

MORE...

VTAIL LIFT.DRAG.MOM.FX.FY.FZ:

56.39	12.82	0.00	12.82	56.39	0.00

NO. OF ITERATION = 4

INITIAL CONDITIONS ARE:

	VELOCITY	DISPLACEMENT
TOR 1110	-1.769011	0.010815
TOR 1120	-0.027402	0.005140
TOR 1210	1.682513	-0.069516
TOR 1220	0.007120	-0.003544
TEET 0	0.282620	0.018433

MORE...

OPOP1120	-0.228842	0.028056
OPOP1220	0.290379	0.023940
IPIP1110	0.033168	-0.004439
IPIP1210	-0.089830	-0.003348

A0 = -0.01518 A1C = 0.00824 A1S = -0.06282

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

9.9995E-01	0.0000E+00	9.5169E-03
0.0000E+00	1.0000E+00	0.0000E+00
-9.5169E-03	0.0000E+00	9.9995E-01

FUSELAGE PITCH ANGLE = -0.0152220

AERODYNAMIC FORCES ARE:

MORE...

TORQ	XFOR	YFOR	ZFOR	HP
-84417.75	-141.93	-172.74	7978.04	-433.97

MOMX	MOMY
-1818.16	2251.94

INDUCED VEL = -0.02037

VEL W.R.T. ROTOR SYSTEM ARE:
-1367.9380 0.0000 13.0192

VEL W.R.T. FUSE SYSTEM ARE:
-1367.9380 0.0000 13.0192

UNBALANCE FORCES ARE:

FX	FZ	MX	MY
7.31	-86.09	-1857.65	-1024.69

FUSLAGE LIFT.DRAG.MOM.FX.FY.FZ:
-2.36 223.91 -4756.73 223.88 0.00 -4.49

MORE...

WING LIFT.DRAG.MOM.FX.FY.FZ:

270.92	24.47	-382.35	27.05	0.00	270.67

HTAIL LIFT.DRAG.MOM.FX.FY.FZ:

-28.64	5.16	0.00	4.89	0.00	-28.69

VTAIL LIFT.DRAG.MOM.FX.FY.FZ:

56.39	12.82	0.00	12.82	56.39	0.00

NO. OF ITERATION = 5

INITIAL CONDITIONS ARE:

	VELOCITY	DISPLACEMENT
TOR 1110	-1.774584	0.009832
TOR 1120	-0.015357	0.005196

MORE...

TOR 1210	1.687107	-0.069426
TOR 1220	-0.008171	-0.003511
TEET 0	0.281262	0.018330
OPOP1120	-0.229909	0.028075
OPOP1220	0.291709	0.023984
IPIP1110	0.033565	-0.004449
IPIP1210	-0.089911	-0.003365

A0 = -0.01565 A1C = 0.00791 A1S = -0.06256

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

9.9995E-01	0.0000E+00	1.0222E-02
0.0000E+00	1.0000E+00	0.0000E+00

MORE...

-1.0222E-02   0.0000E+00   9.9995E-01

FUSELAGE PITCH ANGLE =   -0.0152182

AERODYNAMIC FORCES ARE:

TORQ	XFOR	YFOR	ZFOR	HP
-85514.50	-143.70	-177.26	8131.79	-439.61

MOMX	MOMY
1667.41	3575.41

INDUCED VEL =   -0.02010

VEL W.R.T. ROTOR SYSTEM ARE:
-1367.9285   0.0000   13.9834

VEL W.R.T. FUSE SYSTEM ARE:
-1367.9285   0.0000   13.9834

UNBALANCE FORCES ARE:

MORE...

FX	FZ	MX	MY
-0.16	67.12	1627.93	181.75

FUSLAGE LIFT.DRAG.MOM.FX.FY.FZ:

-2.53	223.90	-4783.14	223.87	0.00	-4.82

WING LIFT.DRAG.MOM.FX.FY.FZ:

270.91	24.47	-382.35	27.24	0.00	270.64

HTAIL LIFT.DRAG.MOM.FX.FY.FZ:

-28.86	5.16	0.00	4.87	0.00	-28.91

VTAIL LIFT.DRAG.MOM.FX.FY.FZ:

56.39	12.82	0.00	12.82	56.39	0.00

NO. OF ITERATION =   6

INITIAL CONDITIONS ARE:

MORE...

	VELOCITY	DISPLACEMENT
TOR 1110	-1.778028	0.011047
TOR 1120	-0.010194	0.005204
TOR 1210	1.693367	-0.069413
TOR 1220	-0.010762	-0.003588
TEET 0	0.280345	0.018444
OPOP1120	-0.230222	0.028071
OPOP1220	0.290117	0.023964
IPIP1110	0.033917	-0.004440
IPIP1210	-0.089645	-0.003349

A0 = -0.01498 A1C = 0.00829 A1S = -0.06279

MORE...

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

9.9995E-01	0.0000E+00	1.0218E-02
0.0000E+00	1.0000E+00	0.0000E+00
-1.0218E-02	0.0000E+00	9.9995E-01

FUSELAGE PITCH ANGLE = -0.0151873

AERODYNAMIC FORCES ARE:

TORQ	XFOR	YFOR	ZFOR	HP
-84918.12	-143.47	-172.72	7967.91	-436.55

MOMX	MOMY
-2092.36	3345.21

INDUCED VEL = -0.02050

VEL W.R.T. ROTOR SYSTEM ARE:

MORE...

```
  -1367.9285       0.0000       13.9782

VEL W.R.T. FUSE SYSTEM ARE:
  -1367.9285       0.0000       13.9782

 UNBALANCE FORCES ARE:

       FX          FZ          MX          MY
      0.10       -96.81    -2131.84     -128.66

FUSLAGE LIFT.DRAG.MOM.FX.FY.FZ:
    -2.53     223.90  -4783.00     223.87      0.00     -4.82

WING LIFT.DRAG.MOM.FX.FY.FZ:
   270.91      24.47   -382.35      27.24      0.00    270.64

HTAIL LIFT.DRAG.MOM.FX.FY.FZ:
   -28.91       5.16      0.00       4.87      0.00    -28.96

VTAIL LIFT.DRAG.MOM.FX.FY.FZ:
    56.39      12.82      0.00      12.82     56.39      0.00

                                                              MORE...

NO. OF ITERATION =     7

INITIAL CONDITIONS ARE:

                    VELOCITY      DISPLACEMENT

  TOR 1110         -1.773714       0.009740

  TOR 1120         -0.015978       0.005187

  TOR 1210          1.685614      -0.069425

  TOR 1220         -0.007143      -0.003500

  TEET    0         0.281244       0.018302

  OPOP1120         -0.229979       0.028075

  OPOP1220          0.291953       0.023986

                                                              MORE...
```

```
  IPIP1110         0.033622            -0.004450

  IPIP1210        -0.089886            -0.003367

A0 =    -0.01570    A1C =      0.00791    A1S =     -0.06251

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

   9.9995E-01    0.0000E+00    1.0187E-02

   0.0000E+00    1.0000E+00    0.0000E+00

  -1.0187E-02    0.0000E+00    9.9995E-01

FUSELAGE PITCH ANGLE =    -0.0152236

AERODYNAMIC FORCES ARE:

        TORQ          XFOR          YFOR          ZFOR          HP
   -85765.50       -143.96       -177.95       8167.77       -440.90

                                                                    MORE...

        MOMX          MOMY
     2300.23       3515.37

INDUCED VEL =     -0.02007

VEL W.R.T. ROTOR SYSTEM ARE:
  -1367.9290        0.0000        13.9361

VEL W.R.T. FUSE SYSTEM ARE:
  -1367.9290        0.0000        13.9361

 UNBALANCE FORCES ARE:

          FX            FZ            MX            MY
       -0.14        103.12       2260.77        124.10

FUSLAGE LIFT.DRAG.MOM.FX.FY.FZ:
    -2.53      223.90   -4781.84      223.87        0.00       -4.81

WING LIFT.DRAG.MOM.FX.FY.FZ:
   270.91       24.47    -382.35       27.23        0.00      270.64

                                                                    MORE...
```

```
HTAIL LIFT.DRAG.MOM.FX.FY.FZ:
   -28.85        5.16       0.00       4.87       0.00     -28.91
VTAIL LIFT.DRAG.MOM.FX.FY.FZ:
    56.39       12.82       0.00      12.82      56.39       0.00
TRIM SECTION TERMINATED AT NITERA =    8
*************************************************************************
COMMAND
```

```
EXECUTION BEGINS...
USER FILE U1 TO BE INITIALIZED (Y OR N)
COMMAND
MODEL NAME (DATA SET)
LIST MODEL SUMMARY (Y OR N)

************************        MODEL AH1T      **********************

AH1 TRIM, GRAVITY FORCE APPLIED THROUGH GLOBAL REF SYS

INDEX    COMP     NO.    DATA SET          FORCE    DATA SET

  1      CRE3      1     B1Z1T1            FRA3     FCT1.65
                                     REQUIRED DS/DM= AFD161   /AIRFOIL
  2      CCE0      1     3000              NONE
  3      CLC1            COUPLE            NONE
  4      CFM2      1     8300-4            FFC2     AH1G16.5
  5      CGL0            TGC               NONE
  6      CLC0            DEL               NONE
                                                                MORE...

*********************************************************************

*********************************************************************
                           GLOBAL  VARIABLES

  1 VSOUND    - SOUND VELOCITY       =  1.13800E+03
  2 RHO       - AIR DENSITY RATIO    =  8.79000E-01
*********************************************************************
```

```
**********************************************************************
SOLUTION INPUT FOR STR3.TRIM SOLUTION

  1 IFUS      - PERIODIC MOTION      =          NO
  2 ITEET     - TEETERING ROTOR      =          YES
  3 TRCOVA7   - VALUE A              =   1.00000E-01
  4 TRCOVA8   - VALUE B              =  -1.24000E-01
  5 TRCOVA9   - VALUE C              =   3.52000E+00
  6 H         - INITIAL INCREMENT    =   3.70370E-03
  7 TPER      - INTEGRATION PERIOD   =   1.85185E-01
  8 HTD       - SEPARATE INCREMENT   =   0.00000E+00
  9 HF        - SEPARATE INCREMENT   =   0.00000E+00
 10 E         - ERROR CHECK VALUE    =   0.00000E+00
 11 ITRIM     - CASE NUMBER          =             2
 12 NALLOW    - NO. OF ITERATIONS    =            10
 13 CEA       - CONSTANT ERROR       =          YES
 14 CEALLO    - CONSTANT ERROR       =   1.00000E-05
 15 EALLOWT2  - (REAL) TRIM ERRORS ALLOWED
              1.00000E-05  1.00000E-05  1.00000E-05  1.00000E-05
              1.00000E-05
 16 CI        - CONSTANT INCREMENT   =          YES
 17 CICRE     - CONSTANT INCREMENT   =   5.00000E-03
 18 DELTAT2   - (REAL) CONTROL VAR INCRMNTS
              5.00000E-03  5.00000E-03  5.00000E-03  5.00000E-03
              5.00000E-03
 19 IWIND     - WIND VELOCITY Y OR N=          NO
 20 VTRANG    - (REAL) FUSELAGE TRANS VEL
             -1.21420E+03  0.00000E+00  0.00000E+00
 21 IROTIN    - FUSELAGE ANGULAR VEL=          YES
 22 VROTG     - (REAL) FUSELAGE ANGULAR VEL
              0.00000E+00  0.00000E+00  5.61100E-02
 23 CT        - ROTOR THRUST         =   8.20000E+03
 24 IGUESS    - INITIAL GUESSES      =          YES
 25 TESTV     - (REAL) INITIAL VELOCITY
             -1.77458E+00  1.68711E+00  2.81262E-01  3.35650E-02
             -8.99110E-02  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00
 26 TESTD     - (REAL) INITIAL DISPLACEMENT
              9.83200E-03 -6.94260E-02  1.83300E-02 -4.44900E-03
             -3.36500E-03  0.00000E+00  0.00000E+00  0.00000E+00
              0.00000E+00  0.00000E+00
 27 A0        - COLLECTIVE COMPONENT= -1.56300E-02
 28 A1C       - COSINE COMPONENT     =   7.91000E-03
 29 A1S       - SINE COMPONENT       =  -6.25800E-02
 30 ICONST    - CONST EULER ANGLE    =ROLL
 31 EULANGLE  - (REAL) GUESS 3 EULER ANGLES
              1.74530E-01  0.00000E+00  0.00000E+00
 32 ISTEAD    - STEADY TIME HISTORY =          NO
 33 CRT       - OUTPUT THIS TERMINAL=          YES
 34 GS        - VERT ACCELERATION    =   1.00000E+00
 35 ICF       - CONSIDER CENTRIFUGAL=          YES
 36 RT        - RADIUS OF TURN       =   1.80380E+03
**********************************************************************
```

```
***************** SOLUTION STR3 FOR MODEL AH1T     *****************
MODEL     - AH1 TRIM, GRAVITY FORCE APPLIED THROUGH GLOBAL REF SYS
SOLUTION - TRIM SOLUTION


NO. OF ITERATION =     1

INITIAL CONDITIONS ARE:

                  VELOCITY        DISPLACEMENT

  TOR 1110       -1.803469          -0.059514

  TOR 1210        1.590745           0.019210

  TEET    0      -2.120655           0.010593

  IPIP1110        0.009785          -0.000660

  IPIP1210       -0.075410          -0.000711
                                                          MORE...

A0 =     0.00307   A1C =    -0.05399   A1S =     0.04679

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

   9.9999E-01   0.0000E+00  -5.0000E-03

   8.6822E-04   9.8481E-01   1.7364E-01

   4.9240E-03  -1.7365E-01   9.8480E-01

ROLL ANG=  0.17453    PITCH ANG=  0.00325    YAW ANG= -0.05025

AERODYNAMIC FORCES ARE:

        TORQ          XFOR        YFOR        ZFOR         HP
   -91815.81       -169.79     -171.17     7626.04     -472.01

        MOMX          MOMY
  -104833.12     -36873.89

INDUCED VEL =    -0.02000
                                                          MORE...
```

```
VEL W.R.T. ROTOR SYSTEM ARE:
  -1213.2446      -1.0271      -5.9721

VEL W.R.T. FUSE SYSTEM ARE:
  -1214.1848      -1.0542      -5.9787

 UNBALANCE FORCES ARE:

        FX          FY           FZ          MX           MY
       40.20      1139.64      -861.44    -88352.75    -43556.26

FUSLAGE LIFT,DRAG,MOM,FX,FY,FZ:
     0.97    176.66  -3322.03    176.65      0.00      1.84

WING LIFT,DRAG,MOM,FX,FY,FZ:
   212.09     19.28   -301.21     18.23      0.00    212.18

HTAIL LIFT,DRAG,MOM,FX,FY,FZ:
   -18.78      4.07      0.00      4.16      0.00    -18.76

VTAIL LIFT,DRAG,MOM,FX,FY,FZ:
                                                              MORE...
    44.42     10.10      0.00     10.06     44.43      0.00


NO. OF ITERATION =    2


INITIAL CONDITIONS ARE:

                      VELOCITY       DISPLACEMENT

  TOR 1110          -1.662546        -0.029787

  TOR 1210           1.658504        -0.010709

  TEET   0          -1.466288         0.016710

  IPIP1110           0.009578        -0.000632

  IPIP1210          -0.003601        -0.000863

AO =      0.00252   A1C =     -0.03445   A1S =      0.01540
                                                              MORE...
```

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

9.9870E-01	-5.0225E-02	-8.2541E-03
5.0895E-02	9.8349E-01	1.7364E-01
-6.0311E-04	-1.7383E-01	9.8477E-01

ROLL ANG= 0.17453 PITCH ANG= 0.00277 YAW ANG= -0.03871

AERODYNAMIC FORCES ARE:

TORQ	XFOR	YFOR	ZFOR	HP
-99547.62	-152.37	483.21	10057.75	-511.75

MOMX	MOMY
-26657.82	4710.71

INDUCED VEL = -0.02145

VEL W.R.T. ROTOR SYSTEM ARE:

MORE...

-1211.6855 -61.7520 0.7389

VEL W.R.T. FUSE SYSTEM ARE:
-1212.6257 -61.7966 0.7323

UNBALANCE FORCES ARE:

FX	FY	FZ	MX	MY
-55.46	1790.86	1562.07	-73293.19	1871.55

FUSLAGE LIFT,DRAG,MOM,FX,FY,FZ:
-0.12 176.08 -3475.58 176.08 0.00 -0.22

WING LIFT,DRAG,MOM,FX,FY,FZ:
212.39 19.23 -300.43 19.36 0.00 212.38

HTAIL LIFT,DRAG,MOM,FX,FY,FZ:
-25.14 4.06 0.00 4.04 0.00 -25.14

VTAIL LIFT,DRAG,MOM,FX,FY,FZ:
44.31 10.07 0.00 7.80 44.76 0.00

MORE...

```
NO. OF ITERATION =    3

INITIAL CONDITIONS ARE:

                  VELOCITY        DISPLACEMENT

  TOR 1110       -1.680462         -0.029032

  TOR 1210        1.683062         -0.010498

  TEET   0       -1.539558          0.017639

  IPIP1110        0.008878         -0.000666

  IPIP1210       -0.005228         -0.000898

A0 =     0.00316   A1C =   -0.03548   A1S =     0.01815

INERTIAL TO GLOBAL TRANSFORMATION MATRIX
                                                         MORE...

   9.9922E-01  -3.8704E-02  -7.7720E-03

   3.9465E-02   9.8402E-01   1.7364E-01

   9.2724E-04  -1.7381E-01   9.8478E-01

ROLL ANG=  0.17453    PITCH ANG=  0.00218    YAW ANG= -0.03933

AERODYNAMIC FORCES ARE:

        TORQ           XFOR         YFOR         ZFOR          HP
   -99828.69        -156.89       250.30      9736.17      -513.20

        MOMX           MOMY
    -2048.88        4963.18

INDUCED VEL =    -0.02307

VEL W.R.T. ROTOR SYSTEM ARE:
  -1212.3132     -47.8768     -1.1192

                                                         MORE...
```

VEL W.R.T. FUSE SYSTEM ARE:
-1213.2534 -47.9189 -1.1259

UNBALANCE FORCES ARE:

FX	FY	FZ	MX	MY
-31.79	1559.32	1240.77	-26221.05	1733.85

FUSLAGE LIFT,DRAG,MOM,FX,FY,FZ:
0.18 176.30 -3434.18 176.30 0.00 0.35

WING LIFT,DRAG,MOM,FX,FY,FZ:
212.42 19.25 -300.74 19.05 0.00 212.44

HTAIL LIFT,DRAG,MOM,FX,FY,FZ:
-25.50 4.06 0.00 4.08 0.00 -25.50

VTAIL LIFT,DRAG,MOM,FX,FY,FZ:
44.35 10.08 0.00 8.32 44.71 0.00

MORE...

NO. OF ITERATION = 4

INITIAL CONDITIONS ARE:

	VELOCITY	DISPLACEMENT
TOR 1110	-1.688733	-0.026937
TOR 1210	1.692024	-0.009648
TEET 0	-1.517574	0.017289
IPIP1110	0.008898	-0.000687
IPIP1210	-0.005120	-0.000906

A0 = 0.00484 A1C = -0.03433 A1S = 0.01694

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

9.9920E-01 -3.9318E-02 -7.1808E-03

MORE...

```
   3.9967E-02   9.8400E-01   1.7364E-01

   2.3873E-04  -1.7379E-01   9.8478E-01

ROLL ANG=  0.17453    PITCH ANG=  0.00134    YAW ANG= -0.03826

AERODYNAMIC FORCES ARE:

        TORQ           XFOR         YFOR         ZFOR          HP
   -100593.06        -154.12       266.83      9823.24       -517.13

        MOMX           MOMY
     7284.31        2594.55

INDUCED VEL =    -0.02307

VEL W.R.T. ROTOR SYSTEM ARE:
   -1212.2896     -48.4897       -0.2832

VEL W.R.T. FUSE SYSTEM ARE:
   -1213.2297     -48.5285       -0.2899
                                                              MORE...

 UNBALANCE FORCES ARE:

         FX             FY            FZ           MX            MY
       -35.55        1575.80       1327.50    -18483.09       -364.35

FUSLAGE LIFT,DRAG,MOM,FX,FY,FZ:
     0.05      176.27  -3454.28     176.27        0.00        0.09

WING LIFT,DRAG,MOM,FX,FY,FZ:
   212.50       19.25   -300.73      19.20        0.00      212.50

HTAIL LIFT,DRAG,MOM,FX,FY,FZ:
   -25.67        4.06      0.00       4.07        0.00      -25.66

VTAIL LIFT,DRAG,MOM,FX,FY,FZ:
    44.35       10.08      0.00       8.30       44.72        0.00


NO. OF ITERATION =     5

                                                              MORE...
```

INITIAL CONDITIONS ARE:

	VELOCITY	DISPLACEMENT
TOR 1110	-1.700868	-0.024573
TOR 1210	1.705497	-0.008566
TEET 0	-1.494236	0.016920
IPIP1110	0.008949	-0.000710
IPIP1210	-0.005246	-0.000918

A0 = 0.00679 A1C = -0.03313 A1S = 0.01558

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

9.9925E-01	-3.8247E-02	-6.3352E-03
3.8766E-02	9.8405E-01	1.7364E-01
-4.0719E-04	-1.7376E-01	9.8479E-01

MORE...

ROLL ANG= 0.17453 PITCH ANG= 0.00045 YAW ANG= -0.03712

AERODYNAMIC FORCES ARE:

TORQ	XFOR	YFOR	ZFOR	HP
-102653.50	-154.51	265.35	10010.18	-527.72

MOMX	MOMY
7197.80	2547.19

INDUCED VEL = -0.02307

VEL W.R.T. ROTOR SYSTEM ARE:
-1212.3467 -47.0357 0.5010

VEL W.R.T. FUSE SYSTEM ARE:
-1213.2869 -47.0700 0.4944

UNBALANCE FORCES ARE:

MORE...

FX	FY	FZ	MX	MY
-39.85	1574.44	1514.14	-18427.57	-375.29

FUSLAGE LIFT,DRAG,MOM,FX,FY,FZ:

-0.08	176.28	-3473.61	176.28	0.00	-0.15

WING LIFT,DRAG,MOM,FX,FY,FZ:

212.60	19.25	-300.76	19.33	0.00	212.59

HTAIL LIFT,DRAG,MOM,FX,FY,FZ:

-25.82	4.06	0.00	4.05	0.00	-25.82

VTAIL LIFT,DRAG,MOM,FX,FY,FZ:

44.35	10.08	0.00	8.35	44.71	0.00

NO. OF ITERATION = 6

INITIAL CONDITIONS ARE:

MORE...

	VELOCITY	DISPLACEMENT
TOR 1110	-1.713992	-0.022191
TOR 1210	1.720093	-0.007395
TEET 0	-1.471865	0.016535
IPIP1110	0.009007	-0.000733
IPIP1210	-0.005409	-0.000930

A0 = 0.00880 A1C = -0.03194 A1S = 0.01426

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

9.9930E-01	-3.7109E-02	-5.4547E-03
3.7492E-02	9.8409E-01	1.7364E-01
-1.0757E-03	-1.7372E-01	9.8479E-01

MORE...

ROLL ANG= 0.17453   PITCH ANG= -0.00040   YAW ANG= -0.03604

AERODYNAMIC FORCES ARE:

TORQ	XFOR	YFOR	ZFOR	HP
-105112.06	-155.40	264.08	10228.60	-540.36

MOMX	MOMY
7087.64	2490.15

INDUCED VEL = -0.02307

VEL W.R.T. ROTOR SYSTEM ARE:
-1212.4053   -45.4934   1.3128

VEL W.R.T. FUSE SYSTEM ARE:
-1213.3455   -45.5230   1.3061

UNBALANCE FORCES ARE:

FX	FY	FZ	MX	MY
-44.75	1573.29	1732.28	-18415.43	-425.67

MORE...

FUSLAGE LIFT,DRAG,MOM,FX,FY,FZ:
-0.21   176.28   -3493.60   176.28   0.00   -0.40

WING LIFT,DRAG,MOM,FX,FY,FZ:
212.70   19.25   -300.79   19.48   0.00   212.68

HTAIL LIFT,DRAG,MOM,FX,FY,FZ:
-25.97   4.06   0.00   4.03   0.00   -25.97

VTAIL LIFT,DRAG,MOM,FX,FY,FZ:
44.36   10.08   0.00   8.41   44.70   0.00

NO. OF ITERATION = 7

INITIAL CONDITIONS ARE:

VELOCITY   DISPLACEMENT

MORE...

```
   TOR 1110        -1.728398         -0.019728
   TOR 1210         1.735839         -0.006139
   TEET   0        -1.449360          0.016135
   IPIP1110         0.009038         -0.000759
   IPIP1210        -0.005608         -0.000943
 A0 =     0.01091    A1C =    -0.03071    A1S =     0.01291
 INERTIAL TO GLOBAL TRANSFORMATION MATRIX
    9.9934E-01  -3.6032E-02  -4.5968E-03
    3.6282E-02   9.8414E-01   1.7364E-01
   -1.7328E-03  -1.7370E-01   9.8480E-01
 ROLL ANG=  0.17453    PITCH ANG= -0.00125    YAW ANG= -0.03498
                                                          MORE...
 AERODYNAMIC FORCES ARE:

        TORQ          XFOR         YFOR         ZFOR          HP
   -107710.81       -156.23       263.01     10454.70      -553.72

        MOMX          MOMY
      6975.04       2425.90

 INDUCED VEL =    -0.02306

 VEL W.R.T. ROTOR SYSTEM ARE:
   -1212.4583     -44.0292       2.1106

 VEL W.R.T. FUSE SYSTEM ARE:
   -1213.3984     -44.0541       2.1039

 UNBALANCE FORCES ARE:

        FX           FY           FZ           MX            MY
      -49.57      1572.34      1958.09    -18425.97       -471.02

                                                          MORE...
```

```
FUSLAGE LIFT,DRAG,MOM,FX,FY,FZ:
    -0.34     176.29  -3513.24     176.29       0.00      -0.65

WING LIFT,DRAG,MOM,FX,FY,FZ:
   212.78      19.25   -300.81      19.62       0.00     212.75

HTAIL LIFT,DRAG,MOM,FX,FY,FZ:
   -26.12       4.06      0.00       4.02       0.00     -26.12

VTAIL LIFT,DRAG,MOM,FX,FY,FZ:
    44.36      10.08      0.00       8.47      44.70       0.00


NO. OF ITERATION =    8

INITIAL CONDITIONS ARE:

                   VELOCITY       DISPLACEMENT

  TOR 1110        -1.743319        -0.017174
                                                                MORE...

  TOR 1210         1.752255        -0.004782

  TEET   0        -1.427094         0.015719

  IPIP1110         0.009057        -0.000786

  IPIP1210        -0.005848        -0.000957

A0 =     0.01313   A1C =    -0.02947   A1S =     0.01154

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

   9.9938E-01  -3.4974E-02  -3.7483E-03

   3.5093E-02   9.8418E-01   1.7364E-01

  -2.3839E-03  -1.7367E-01   9.8480E-01

ROLL ANG=  0.17453    PITCH ANG= -0.00209    YAW ANG= -0.03394

AERODYNAMIC FORCES ARE:
                                                                MORE...
```

TORQ	XFOR	YFOR	ZFOR	HP
-110512.25	-157.07	261.90	10691.96	-568.12

MOMX	MOMY
6863.21	2358.40

INDUCED VEL = -0.02306

VEL W.R.T. ROTOR SYSTEM ARE:
-1212.5083 -42.5899 2.9012

VEL W.R.T. FUSE SYSTEM ARE:
-1213.4485 -42.6102 2.8946

UNBALANCE FORCES ARE:

FX	FY	FZ	MX	MY
-54.39	1571.34	2195.07	-18431.02	-513.91

FUSLAGE LIFT,DRAG,MOM,FX,FY,FZ:
-0.47 176.29 -3532.71 176.29 0.00 -0.89

MORE...

WING LIFT,DRAG,MOM,FX,FY,FZ:
212.86 19.25 -300.84 19.76 0.00 212.82

HTAIL LIFT,DRAG,MOM,FX,FY,FZ:
-26.26 4.06 0.00 4.00 0.00 -26.27

VTAIL LIFT,DRAG,MOM,FX,FY,FZ:
44.37 10.08 0.00 8.52 44.69 0.00

NO. OF ITERATION = 9

INITIAL CONDITIONS ARE:

	VELOCITY	DISPLACEMENT
TOR 1110	-1.757343	-0.014681
TOR 1210	1.767384	-0.003423

MORE...

```
  TEET   0       -1.406184          0.015290

  IPIP1110        0.009075         -0.000812

  IPIP1210       -0.006142         -0.000970

A0 =    0.01532   A1C =    -0.02825   A1S =    0.01025

INERTIAL TO GLOBAL TRANSFORMATION MATRIX

   9.9942E-01  -3.3933E-02  -2.9052E-03

   3.3921E-02   9.8422E-01   1.7364E-01

  -3.0328E-03  -1.7364E-01   9.8480E-01

ROLL ANG=  0.17453    PITCH ANG= -0.00290    YAW ANG= -0.03299

AERODYNAMIC FORCES ARE:

        TORQ         XFOR         YFOR         ZFOR          HP
                                                                 MORE...
  -113567.31      -158.05       260.86     10941.59      -583.83

        MOMX         MOMY
     6738.11      2293.01

INDUCED VEL =   -0.02306

VEL W.R.T. ROTOR SYSTEM ARE:
  -1212.5554    -41.1716       3.6891

VEL W.R.T. FUSE SYSTEM ARE:
  -1213.4956    -41.1873       3.6825

 UNBALANCE FORCES ARE:

       FX           FY           FZ          MX           MY
      -59.34      1570.41      2444.42   -18456.79      -560.50

FUSLAGE LIFT,DRAG,MOM,FX,FY,FZ:
    -0.59     176.29  -3552.09     176.29       0.00      -1.13

WING LIFT,DRAG,MOM,FX,FY,FZ:
                                                                 MORE...
```

```
   212.94      19.26   -300.86      19.90       0.00     212.88

HTAIL LIFT,DRAG,MOM,FX,FY,FZ:
   -26.40       4.06      0.00       3.98       0.00     -26.41

VTAIL LIFT,DRAG,MOM,FX,FY,FZ:
    44.37      10.08      0.00       8.57      44.69       0.00

TRIM SECTION TERMINATED AT NITERA =  10
****************************************************************
COMMAND
```